ASSEMBLY INSTRUCTIONS

The JMC Environmentalist's Sub-soil Probe has been shipped to you in three pieces. Don't panic! Assembly requires no advanced degrees or unusual tools. You'll need a wrench (If you must, pliers will do.), and a standard (not phillips) screwdriver.

If you take everything out of the box we shipped, you should have a total of three metal pieces. You will also have a number of vinyl caps (both red and black), a wooden dowel, a long cleaning brush, and several clear copolyester tubes 36 inches long. For now, just concern yourself with the three metal components.

The smallest of the three, an aluminum ground pad, attaches to the bottom of the jack fulcrum by means of two bolts. (Refer to Diagram One.) When you have the ground pad firmly attached to the jack fulcrum, put away your tools, The JMC Environmentalist's Sub-Soil Probe is ready to go to work for you.

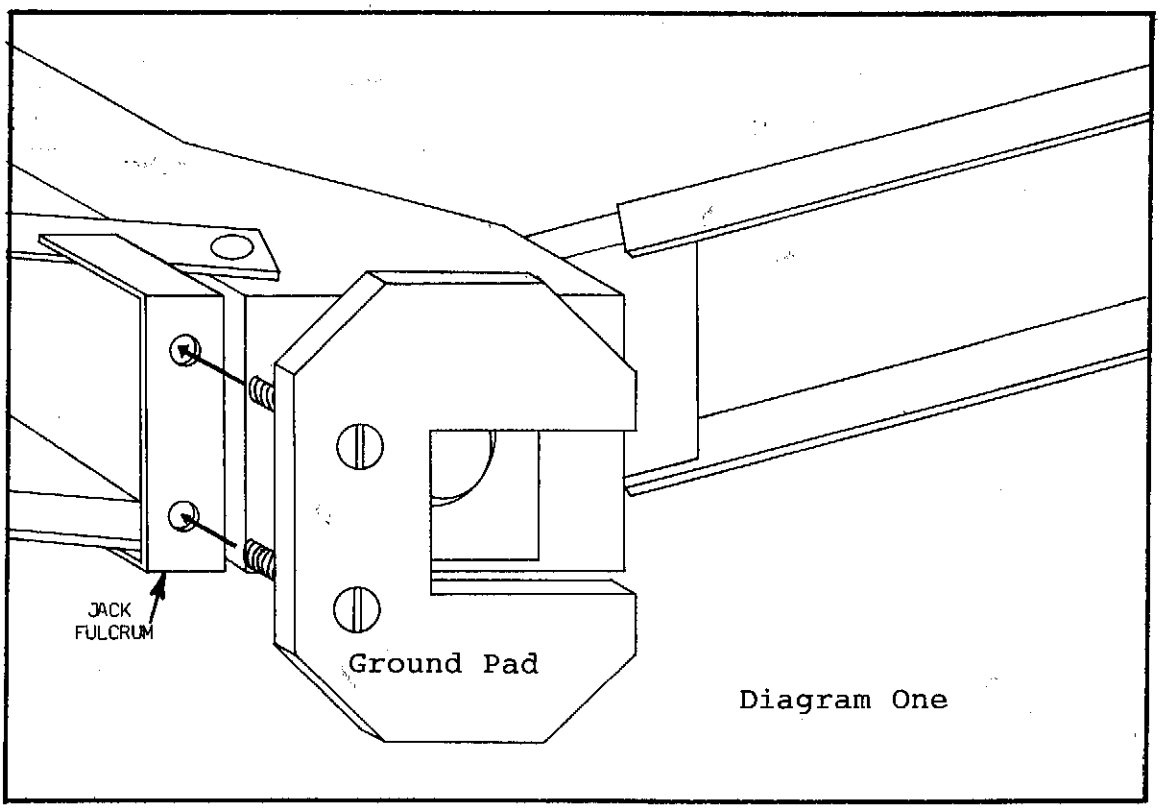
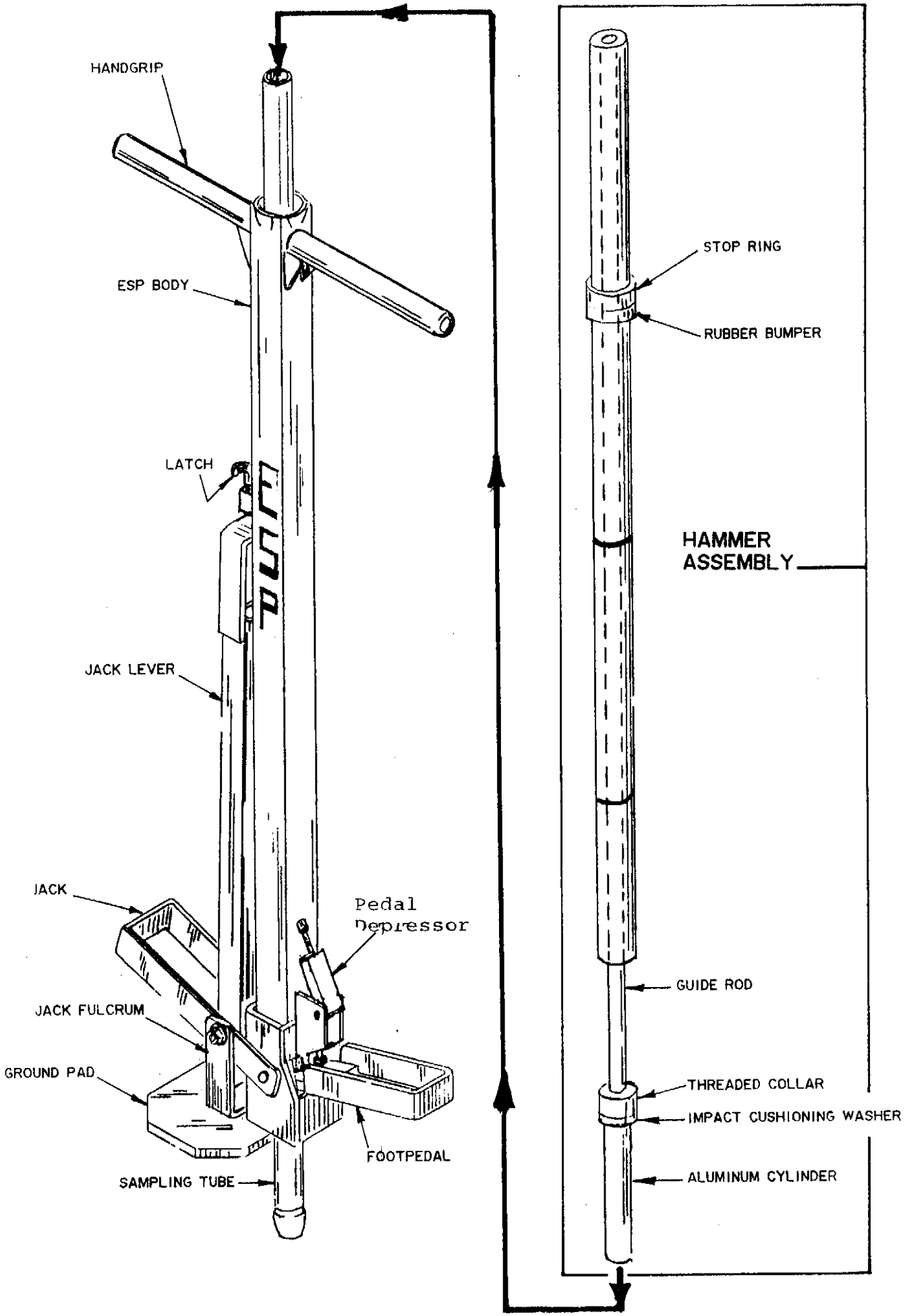


Diagram One


HANDGRIP
ESP BODY
LATCH
JACK LEVER
JACK
Pedal
Depressor
JACK FULCRUM
GROUND PAD
FOOTPEDAL
SAMPLING TUBE
STOP RING
RUBBER BUMPER
HAMMER
ASSEMBLY
GUIDE ROD
THREADED COLLAR
IMPACT CUSHIONING WASHER
ALUMINUM CYLINDER

OPERATOR'S GUIDE TO THE JMC ENVIRONMENTALIST'S SUB-SOIL PROBE

Take a moment to inspect Diagram Two below.

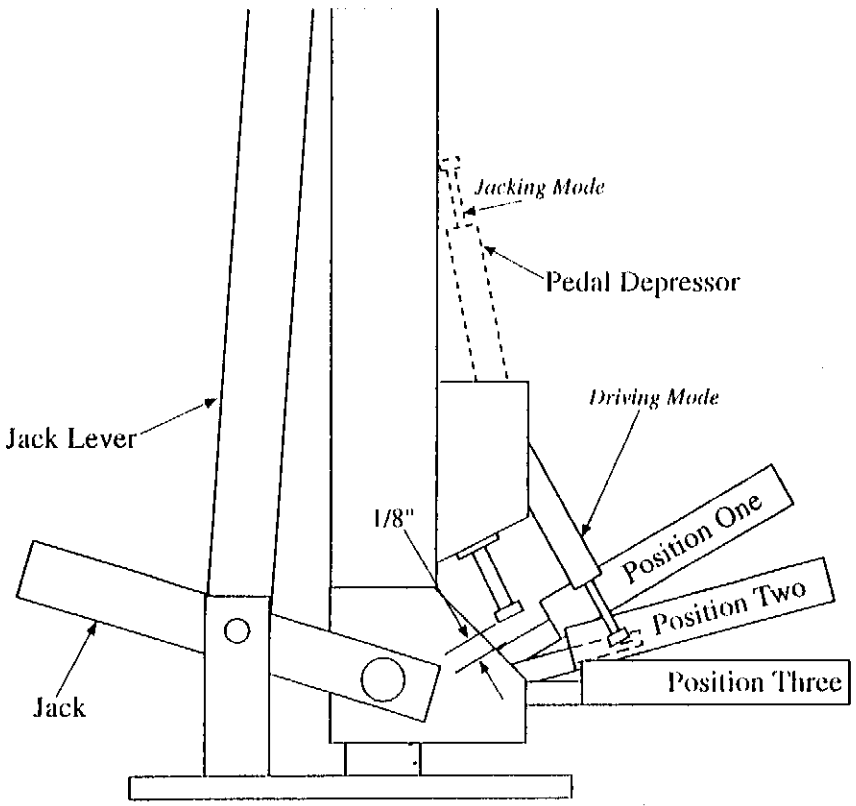


Diagram Two Notes: *The drawing shows the area surrounding the footpedal of the JMC Environmentalist's Sub-Soil Probe. The footpedal has three positions. In position one(jacking mode), the footpedal allows the sampling tube to be retracted, but prevents the tube from sliding back out. In position two (driving mode), the tube moves freely in either direction. And in position three, the footpedal immobilizes the tube.*

The placement of your feet and the orientation of the pedal depressor control the footpedal's position. In position one, both feet are on the ground while the pedal depressor is in the jacking mode. In position two, both feet remain on the ground, but the pedal depressor is in the driving mode. In position 3, one foot presses down hard upon the footpedal which disables the pedal depressor.
As you read the rest of this manual, refer to this page often!

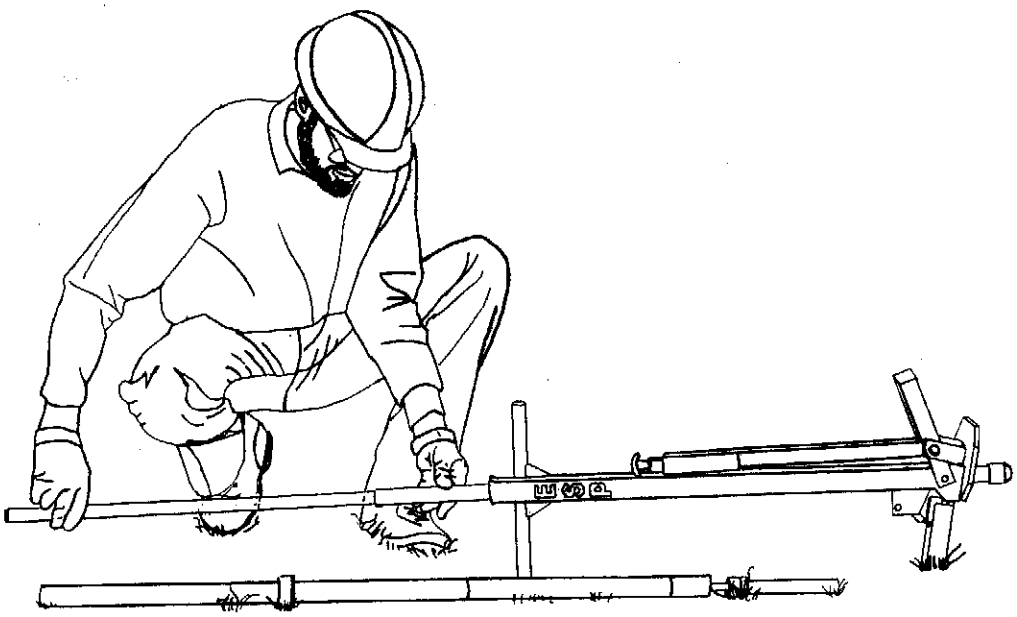
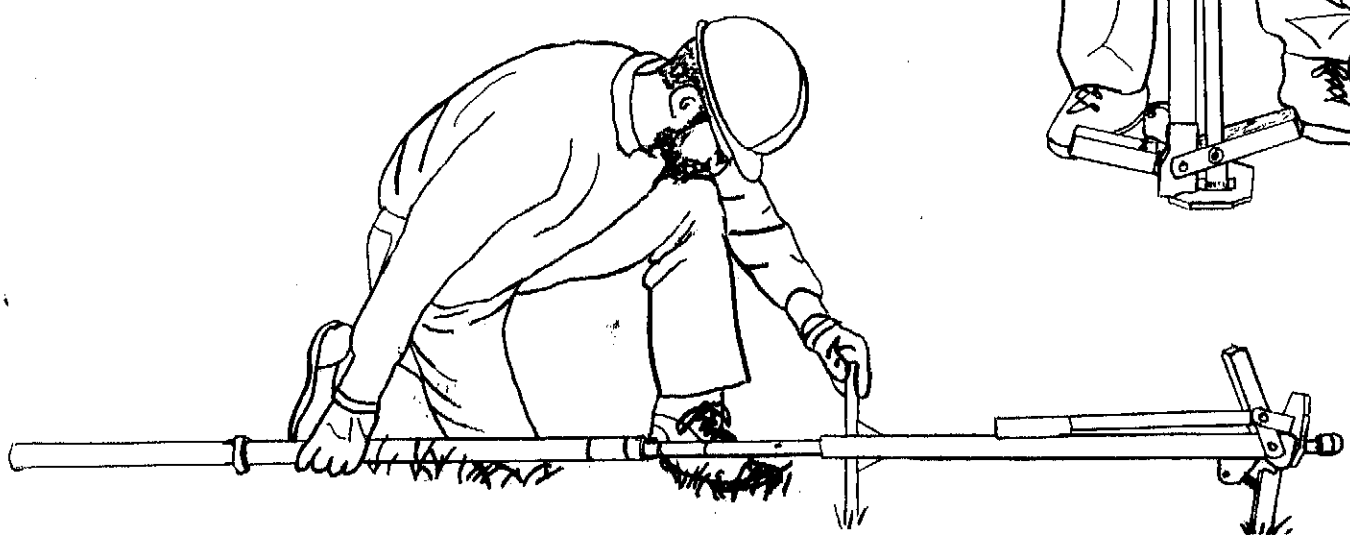


Diagram 3 (above): *Inserting the Liner.*

Diagram 4 (below): *Inserting the Hammer Assembly.*

Diagram 5 (at right): *Driving the Sampling Tube.*



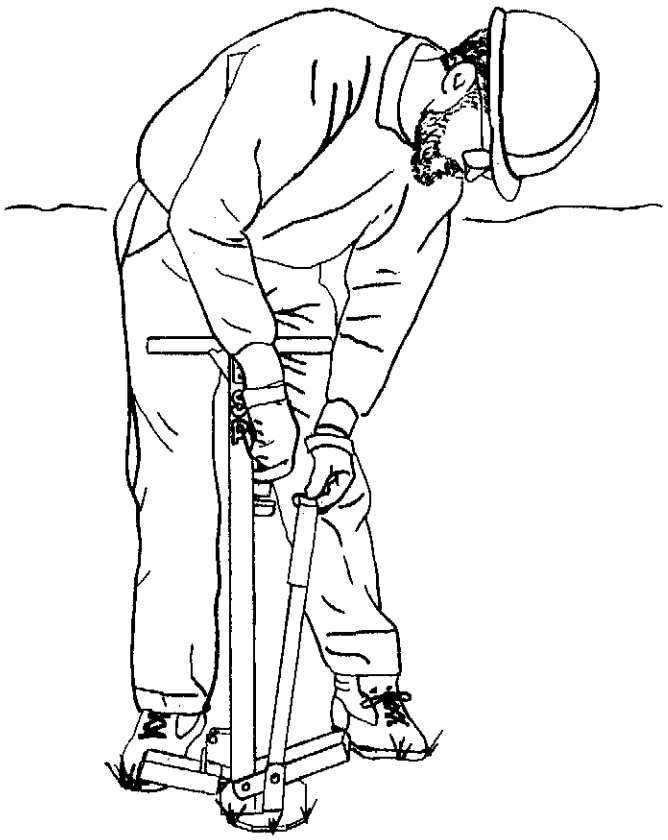


Diagram 6 (above): *Releasing the Jack Lever.*

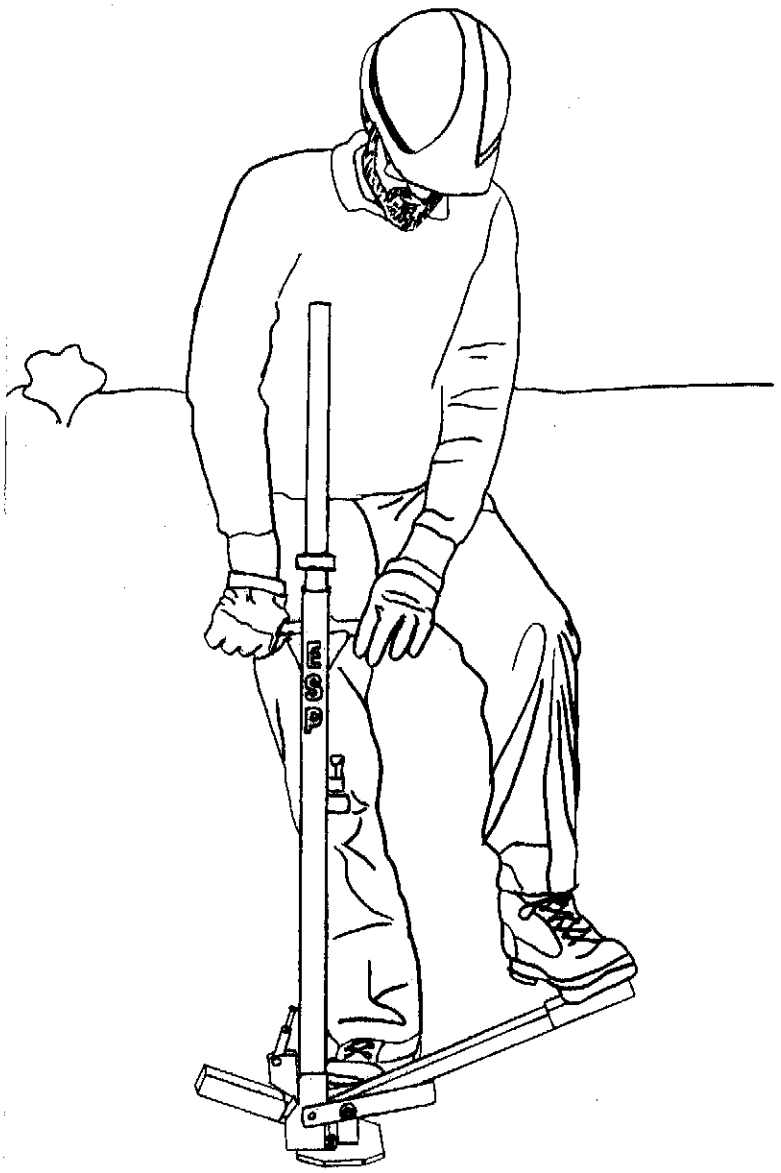


Diagram 7 (above): *Retrieving the Sampling Tube.*

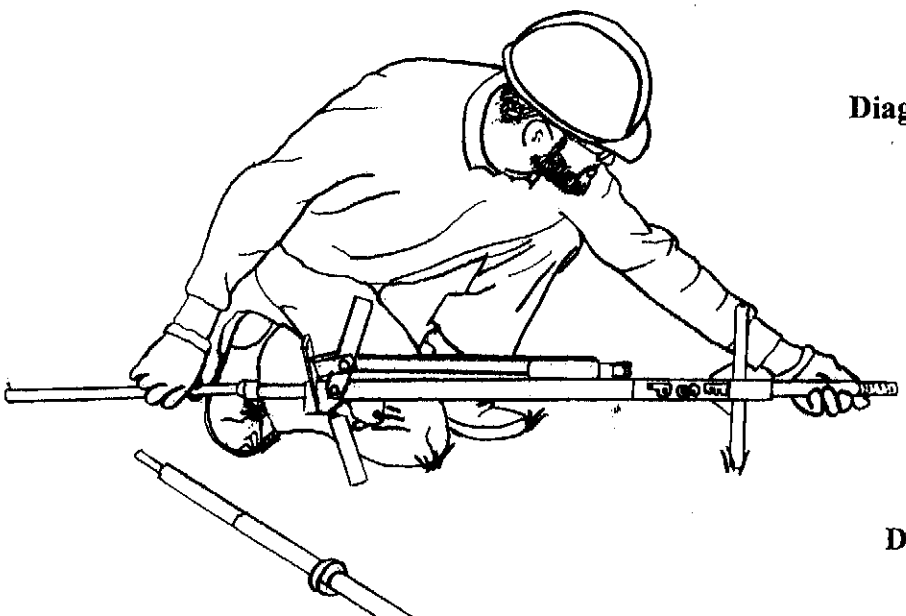


Diagram 8 (at left): *Extracting the Liner and Soil Sample.*

OPERATING INSTRUCTIONS

1. Lay the ESP horizontally on the ground (See Diagram 3). Insert a liner (one of the clear plastic or optional stainless steel tubes 36" long and 15/16" in diameter) into the top of your sampling tube.

2. Pick up both pieces of the hammer assembly. Insert the aluminum cylinder section of the guide rod into the top of the sampling tube (See Diagram 4). Make sure that the end of the hammer is in contact with the threaded collar adjacent to the aluminum cylinder. Move the pedal depressor into the driving mode position.

Caution: *Be aware of pinch points as shown in Diagram 9. Wear leather gloves to protect your hands.*

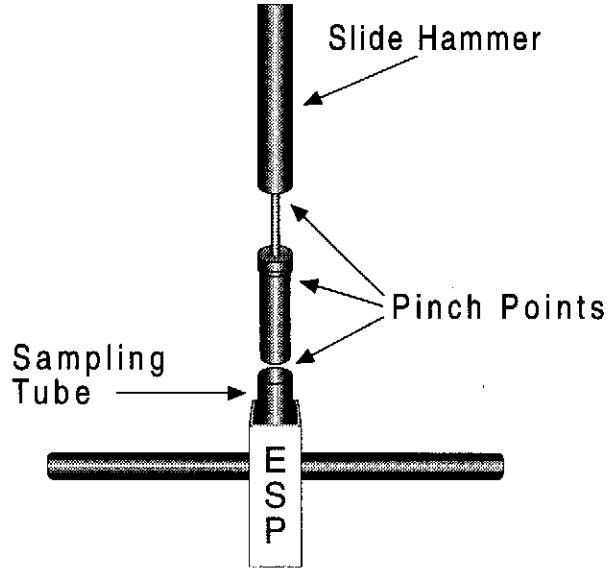


Diagram 9: *Avoid pinching your fingers in these locations.*

3. Tip the ESP and the hammer assembly as a single unit into a vertical position.

Caution: *The apparatus extends above the eye level of most individuals. Check for overhead obstructions such as utilities, structures, branches, etc. Wear a hard hat to prevent head injuries from falling objects.*

4. Double check that the pedal depressor remains in the driving mode position before using the hammer. Failure to do so may result in damage to both the sampling tube and the footpedal.

Caution: *Striking buried utilities can be dangerous and expensive. Locate underground utilities before you begin sampling.*

Caution: *It is possible for the guide rod to break and slide out of the hammer as it is moved to the up position. Wear long pants and leather shoes with safety toes and rubber soles.*

5. Position feet in a stance of 12 to 18 inches as illustrated in Diagram 5. Grip the hammer with both hands like a baseball bat. (Be sure to keep your hands positioned to avoid getting them pinched between the hammer assembly and the top of the threaded collar.) Then, raise the hammer approximately 12 to 18 inches above its resting position. Drive the hammer sharply against the top of the sampling tube.

> **NOTE:** Remember to keep your strokes short (less than 18 inches). Longer strokes prove to be detrimental both to the long-term usefulness of the system and to the short-term condition of the operator.

Assuming you meet no obstacles, continue driving the sampling tube into the ground until the rubber bumper on the underside of the stop ring around the hammer meets the top of the ESP body. At this point, the sampling tube is full and ready to be extracted from the ground.

Caution: *It is possible for a spark to be produced by the impact of the hammer against the rest of the apparatus as well as loud noise. Do not use in an explosive environment. Wear safety glasses and ear protection. You should see or feel the tube move with each blow. If not, discontinue pounding. You may have encountered a rock in which case you will need to start over with a new hole.*

6. Depress the footpedal so you can swing the pedal depressor out of the way. The jack will not work with the pedal depressor in the driving mode position.

7. Release the jack lever by pulling upward on the black plastic handle and pulling the jack lever away from the ESP body. The jack lever should then move into a position roughly 45 degrees to the ESP body making the probe look like a lop-sided pogo stick. (See Diagram 6.)

8. To extract the sampling tube from the ground, put one foot on the jack lever and leave the other on the ground (See Diagram 7). Now, step on the jack lever. This will raise the sampling tube and ESP body approximately 1 to 1-1/2 inches. Next, shift your weight from the jack lever to your other foot, but do not remove your foot from the jack lever. While resting one foot lightly on the jack lever, press down on the handgrips. You will notice that the jack lever returns to its former 45 degree angle position. Repeat this procedure several times to elevate the sampling tube about two feet.

9. When you can see the bottom of the hammer, remove the hammer assembly. Avoid pinching your fingers between the threaded collar and hammer by grasping the threaded collar with one hand and the hammer with the other. Continue jacking until the sampling tube is out of the ground. Return the jacking lever to its original upright position and secure it with the black plastic knob mounted on the side of the probe.

Caution: *Be aware of pinch points as shown in Diagram 9. Wear leather gloves to protect your hands.*

10. Lay the ESP horizontally on the ground. Insert the supplied dowel into the cutting end of the sampling tube and push out the soil core and liner (See Diagram 8). Then put caps over both ends of the liner.

Now, you are ready to start over again at step one with another liner.

SAMPLING WITH EXTENSIONS

Once you have obtained your first three foot sample (steps 1 through 10), you are ready to add extensions and gather deeper samples. First, however, you need to read the following section titled "Living With Pin and Crosshole Connections". **It is your responsibility to inspect and secure extension connections every time you re-enter a sampling hole. Clements Associates, Inc. will not replace free of charge any components you lose down a hole.**

Living with Pin and Crosshole Connections

Your extensions fasten to each other and to your sampling tube by means of a pin and crosshole connection. One end of each extension fits inside the next extension (or sampling tube). A hole drilled through both parts, accepts a pin which keeps the two parts connected.

Your extensions will be subjected to severe stress and vibration. The pins that hold your chain of extensions and sampling tube together will eventually wear out or break. Don't get upset about it, just watch for it. Every time you add or remove a sampling tube or extension, examine the pins. Look for cracks and other signs of excessive wear. Replace pins as necessary.

Once inserted, vibration may cause a pin to "walk" out of its crosshole. To prevent this, you must monitor the condition of a spring-loaded ball (called a "ball plunger") inside each crosshole. As a pin enters the crosshole, you should feel resistance as the pin depresses the ball plunger. If you don't feel the ball snap into the groove in the center of the pin, you need to tighten or replace the ball plunger. (See Trouble Shooting Section elsewhere in this manual.)

As a further precaution, wrap electrical tape around the two crossholes closest to the sampling tube before reinserting your probe into the sampling hole. Even if a pin breaks in half during the sampling procedure, the electrical tape will hold the pin in the crosshole which will, in turn, keep you from losing any equipment underground.

Finally, we recommend purchasing our JMC Pin Ejection Tool (See catalog #10 page 5). This device will make removing and inserting pins much easier.

If you follow the above suggestions, you will find our JMC Environmentalist's Sub-Soil Probe to be very reliable machine. While it may seem bothersome to check ball plungers and pins prior to wrapping tape around the connections, rest assured it is much more troublesome (and time consuming!) to fetch a backhoe to retrieve a sampling tube lost down a sampling hole.

SAMPLING PROCEDURE BELOW THREE FEET

11. While the ESP is lying horizontally on the ground, insert a new liner into the sampling tube.

12. Slide the master extension adapter (which is the lower , and shorter, portion of the master extension assembly) into the upper end of the sampling tube. Secure the adaptor with the stainless steel pin. Wrap a piece of the electrical tape around the connections to cover the crossholes and prevent the pin from "walking" out of the holes. (If you have not read the section titled "Living with Pin and Crosshole Connections", do so right now!) The adapter should still be connected to the master extension.

13. Lift the ESP into a vertical position placing the cutting tip of the sampling tube in the hole left in the ground by the previous coring. Advance the sampling tube 6 to 12 inches into the hole by pushing the master extension assembly downward by hand.

14. Place one foot on the foot pedal and exert a light downward pressure on the pedal at the same time lift up on the handgrips to elevate the ESP body 6 to 8 inches. The sampling tube and extensions should remain planted in the ground.

15. Step down hard on the footpedal forcing the sampling tube down the hole.

16. Repeat this procedure until the sampling tube has reached the bottom of the hole.

17. Insert the hammer assembly into the top of the master extension.

Caution: *Be aware of pinch points as shown in Diagram 9. Wear leather gloves to protect your hands.*

18. Place the pedal depressor in the driving mode position (position 2). Then, drive the tube into the ground until the hammer stop ring rests against the top of the ESP body. At this point, the sampling tube is full and ready to be extracted from the ground.

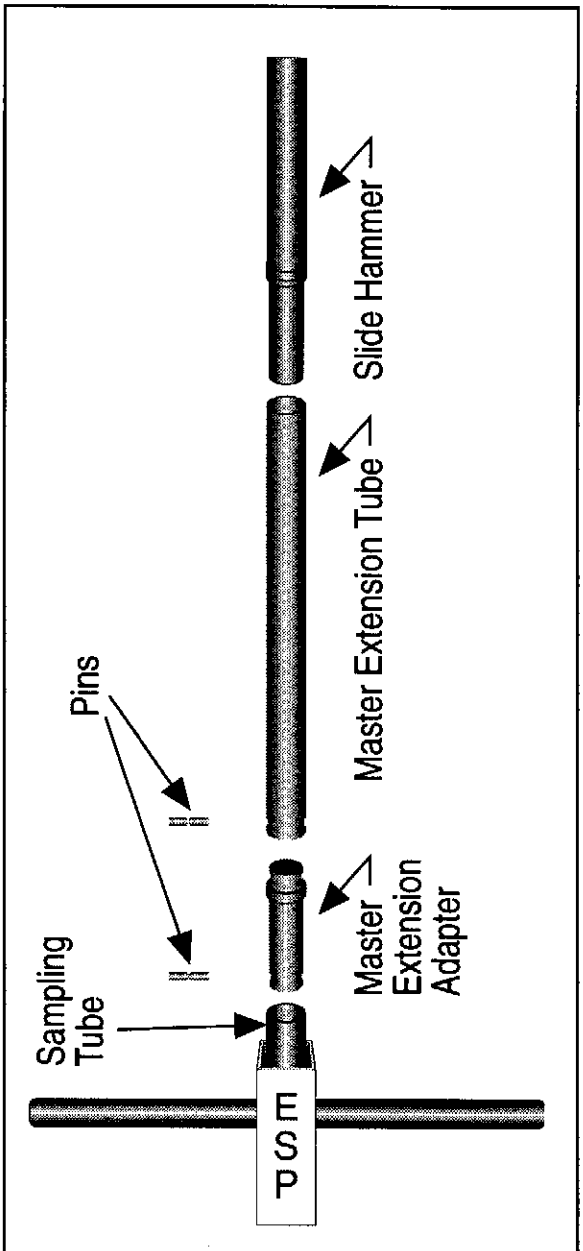


Diagram 10: *Connecting the JMC Master Extension.*

Caution: *Striking buried utilities can be dangerous and expensive. Locate underground utilities before you begin sampling. It is possible for the guide rod to break and slide out of the hammer as it is moved to the up position. Wear long pants and leather shoes with safety toes and rubber soles.*

19. Move the pedal depressor to the jacking mode position.
20. Release the jack lever.
21. Use the jack lever to elevate the sampling tube about two feet as you did in step eight.
22. When you can see the bottom of the hammer, remove the hammer assembly. Continuing jacking another foot. Then remove the electrical tape and finish jacking the sampling tube and extension out of the ground.

Caution: *Be aware of pinch points as shown in Diagram 9. Wear leather gloves to protect your hands.*

NOTE: When the tube has been elevated approximately 36 inches, the jack may seem to stop working. This is normal. The portion of the hole made by your earlier coring has been sized-out to a larger diameter when your tube reentered it. This larger diameter section offers very little friction between the sampling tube and the soil surrounding it. Without this friction, the jack won't release its grip on the sampling tube at the top of each stroke.

When this occurs, secure the jack lever, as described in step #9, to prevent the lever from striking your leg during the following procedure. Place both feet on the ground and lift upward with moderate force on the handgrip. Elevate the sampling tube and extension 6 to 8 inches. Then, push downward on the handgrips so that the bottom of the ESP rests on, or close to, the ground. At this point you can try using the jack lever again or you can continue lifting the tube out of the ground.

If you choose to continue lifting the ESP body and sampling tube by the handgrips, remember to make several short lifts of 6 to 8 inches rather than one or two large pulls. Keep the handgrips at or below waist level.

Caution: *Back injury can result from improper lifting technique. Keep back straight. Lift by bending knees.*

23. Raise the jack lever to its original resting position and secure it with the black plastic knob.
24. Lay the ESP with the master extension assembly still attached to the sampling tube on the ground.
25. Remove the pin at the top of the sampling tube (the one that holds the master extension adapter in place).

26. Unload the soil core and liner.
27. Load another liner.
28. Reattach the master extension adaptor to the sampling tube. (Don't forget to check the pin and ball plunger. Then wrap the connection with electrical tape).
29. Remove the upper pin connecting the master extension tube with the master extension adaptor.
30. Slide the female end of a regular extension over the exposed end of the master extension adaptor and secure it with a pin and electrical tape. (Again, check pin and ball plunger).
31. Attach the master extension to the other end of the regular extension. (Check pin and ball plunger).
32. Repeat steps 13 through 28.

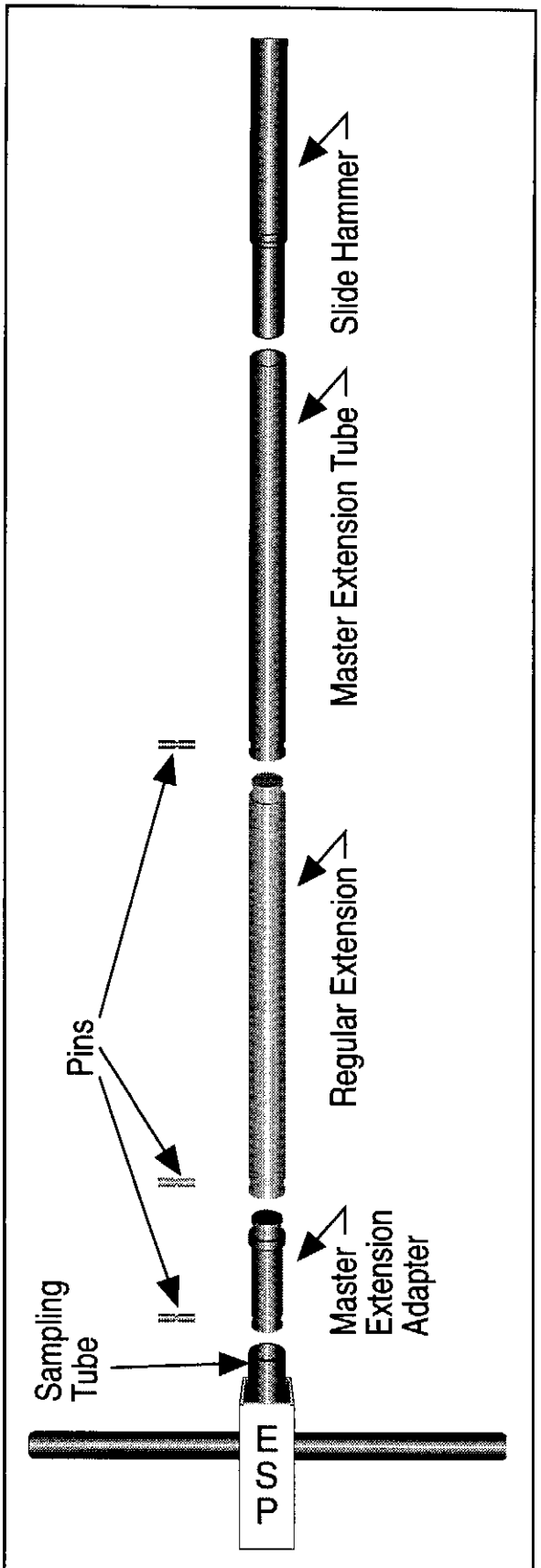


Diagram 11: *Attaching the JMC Regular Extension*

TROUBLE SHOOTING SECTION

Problem: Foot-operated jack won't pull the tube out of the ground.

Solution: If your sampling tube is new, the jack may have trouble gripping it. You can improve the jack's performance by rubbing moist soil or 90 grit aluminum oxide (available from us as part number 175) on the exterior of the sampling tube. If that doesn't work, your pedal release screw needs to be adjusted. As shown in diagram 4, the clearance between this screw and the footpedal should be 1/8 inch when the footpedal is in position #1.

Problem: Liners crumple and/or jam inside the sampling tube.

Solution: The core guide located just inside the cutting tip is missing. Refer to the exploded view and parts list elsewhere in this manual for a part number to order. Meanwhile, the following information will let you continue working:

Soil entering the tube has slipped into the gap between the end of the liner and the ledge just inside the cutting tip. (You can feel this ledge with your finger if you reach inside the cutting end of your sampling tube).

To unjam the tube you unscrew the cutting tip and use the wooden dowel (or a rod the same diameter as the liner) to remove your sample. Be sure to clean, and especially, to dry the sampling tube before attempting another sample.

To prevent future jamming, check each liner when inserting it into the sampling tube. You should not be able to feel a gap between the end of the liner and the ledge on which it sits when you put your finger inside the cutting end. If a gap is present, you will need to remove the hammer assembly (or master extension adaptor if you are using extensions) and insert an American 25 cent piece inside the sampling tube on top of the liner to fill the gap.

Problem: Cutting tips have chipped.

Solution: Your cutting tip may chip over time. This looks bad, but shouldn't affect the performance of your sampler. If you notice scars along the length of your soil cores, you may want to file the burr on the inside of your cutter. Be careful! If you enlarge the inside diameter of your cutter too far, soil will have difficulty entering the liner.

Problem: Even though the sampling tube is driven into the ground until the hammer's stop ring meets the top of the ESP body, the liner isn't full when removed from the sampling tube.

Solution: Either you have sampled into the water table or your sample is being compacted. See Measuring the Compaction of Your Sample on the last page of this document.

Problem: Ball plunger in master extension adapter* doesn't engage pin.

Solution: Ball plunger needs adjustment or replacing. You will need an allen wrench, a butane torch, and a standard screw driver. Alternatively, you may send the extension back to us for repairs (we will, however, charge you for the repair).

At both ends of the Master Extension's Adapter you will find a socket head screw. Remove it with your allen wrench to reveal the slot in the head of the ball plunger. Turning this slot clockwise will tighten the ball plunger while turning it counter-clockwise will loosen the ball plunger. Before you try to move the ball plunger, however, you must heat the area to 400 degrees Fahrenheit. Otherwise, the thread locking compound won't release the ball plunger and screwdriver slot. Once heated, you should remove the ball plunger entirely and let everything cool down to a more comfortable temperature.

When you replace the ball plunger, you should first apply a couple drops of Loctite #271 thread locking compound to the threads. Then, insert a pin into the crosshole and turn the ball plunger clockwise until you engage the pin. You want the ball plunger to hold the pin tightly, but still loosely enough to allow the pin to be poked out of the crosshole with a screwdriver or our JMC Pin Ejection Tool. After you are satisfied with the adjustment, screw the allen head socket screw back into place. Wait a few minutes before using the extension. The thread locking compound needs time to set.

*The same procedure applies when adjusting ball plungers in regular extension.

Other problems? Call us right now! [redacted] or 1-515-792-8285. If you get our answering machine, please leave a message. We will call you as soon as possible.

OTHER WORDS OF CAUTION:

1. The JMC Environmentalist's Sub-Soil Probe will not sample soils saturated with rocks and other debris. While the cutting tips are durable, you sample in these situations at your own risk. Keep your strokes short whenever you drive the sampling tube into the ground and you stand a better chance of keeping your cutting tip intact.

2. Because of their size, the pins used with the ESP extensions are easily lost. It's good idea to leave them in place whenever you are not using an extension. In other words, do not put them on the ground or in your pocket! Rather, you should leave them in their respective holes until you must remove them to make use of your equipment. Of course, we sell replacement pins, but even overnight delivery is an inconvenience. One other bit of advice: The pins are designed to fit flush with the diameter of your extensions. For safety and efficiency we recommend purchasing and using our pin ejection tool (See catalog #10 page 5). It saves wear on your fingers.

3. This may seem obvious, but it should be emphasized. Do not forget to fasten each and every extension with a stainless steel pin. While it is possible to drive the sampler into the ground without pins, it is difficult to retrieve those same extensions when they are disconnected. If you haven't read the section of the manual labeled "Living with Pin and Crosshole Connections", do so right now! We will not be held responsible for parts you lose down a sampling hole.

4. Before you go out to the field, you need to be aware that samples obtained from saturated soil may be compacted by the sampling process. While we do have a cutting tip for wet conditions available (order part PN177), you will find that it can be more easily damaged by stones than our standard tip. For most applications, compaction of the sample is not a problem, provided the degree of compaction is known. With a measuring tape, you can easily determine exactly when and where this compaction occurs. See Measuring the Compaction of Your Sample elsewhere in this manual.

MEASURING THE COMPACTION OF YOUR SAMPLE

You will need a measuring tape (less than 0.9 inches wide) which will fit inside your liners.

Compaction can be determined while obtaining a sample. To begin, you will need to drive the sampling tube twelve inches into the ground. (Notice that grooves have been cut into the outside of the drop hammer at one foot intervals. When the first groove on your drop hammer is level with the top of the ESP body, which will be referred to as point A, your sampling tube has penetrated one foot). Leaving your sampling tube embedded in the ground, remove both pieces of the Drop Hammer assembly from your sampling tube. Measure the distance between ground level and the top of the probe. It should be near 32.5 inches.

Next, you want to find how far it is from point A to the top of your sample inside the tube. To do this, lower your measuring tape through the top of the ESP body and the inside your sampling tube until it touches the top of your sample. If compaction exists, this measurement will exceed the measurement you found outside the ESP body. The difference between the two measurements tells you how much compaction occurred in the first twelve inches of your sample.

For example, if you measured the distance from ground level to point A to be 32.5 inches and you then found that your measuring tape could be inserted 35 inches inside the ESP body before reaching the top of the sample, the first twelve inches of your sample has been compacted 2.5 inches. Or stated another way, the first 9.5 inches of your soil core will represent the soil cross-section found at a depth of 0 to 12 inches at your sampling site.

The procedure for finding the compaction at depths of 12 to 24 inches and 24 to 36 inches is identical to that described above with one modification. When finding compaction of the 12 to 24 inch section, you must subtract the amount of compaction calculated for the first 12 inches from your measurement taken from the inside of the sampling tube. Similarly, with the 24 to 36 inch section, you must subtract the amount of compaction found in both the previous sections from your measurement inside the sampling tube. In all cases, the measurement from ground level to the top of the probe taken outside the probe will be the same.

LET'S LOOK AT A MORE COMPLETE EXAMPLE

The distance from ground level to the top of the ESP body was found to be 32.5 inches as measured with a measuring tape on the exterior of the ESP body. After driving the sampling tube 12 inches the drop hammer was removed. A measuring tape inserted from the point A down into the sampling tube revealed that the top of the sample was 35 inches from the top of point A. The drop hammer was replaced and the tube driven another 12 inches into the ground. This time, the distance from the top of the sample inside the tube to point A was found to be 36 inches. Finally, after pounding until the stop ring on the drop hammer rested against the top of the ESP body, the distance from the top of the sample inside the tube to point A measured 36 inches. Once the liner and soil core had been removed from the sampling tube, it was discovered that the soil core measured 32.5 inches. Obviously, the sample had been compacted during the procedure. Use the above data to determine the extent and location of compression.

For the first 12 inches: *35-32.5=2.5 inches compression.*

For the 12 to 24 inch section: *36-32.5-2.5=1 inch compression.*

For the 24 to 36 inch section: *36-32.5-2.5-1=0 compression.*

Therefore, the first 9.5 inches (12-2.5=9.5) of the soil core corresponds to the 0 to 12 inch section. The next 11 inches (12-1+11) of the soil core are representative of the 12 to 24 inch section. And, the final 12 inches of the soil core exhibit material from the 24 to 36 inch depth.

As a final check, it is noted that the three sections of the soil core described above do indeed equal the measured length of the soil core. (9.5+11+12=32.5).

SAFETY CONCERNS

Caution: *Be aware of pinch points as shown in Diagram 9. Wear leather gloves to protect your hands.*

Caution: *The apparatus extends above the eye level of most individuals. Check for overhead obstructions such as utilities, structures, branches, etc. Wear a hard hat to prevent head injuries from falling objects.*

Caution: *Striking buried utilities can be dangerous and expensive. Locate underground utilities before you begin sampling.*

Caution: *Loud noise and sparks may be produced by the impact of the hammer against the rest of the apparatus. Do not use in an explosive environment. Wear safety glasses and ear protection.*

Caution: *It is possible for the guide rod to break and slide out of the hammer as it is moved to the up position. Wear long pants and leather shoes with safety toes and rubber soles.*

Caution: *Back injury can result from improper lifting technique. Keep back straight and lift by bending knees.*