

2300 ft

SURFACE PROFILE

**Betsy**® **SEISGUN**  
**SOURCES**

*First choice for shallow  
hi-rez surveys*

**BETSY SEISGUN INC.**

P.O. Box 471143  
Tulsa, OK 74147-1143 U.S.A.

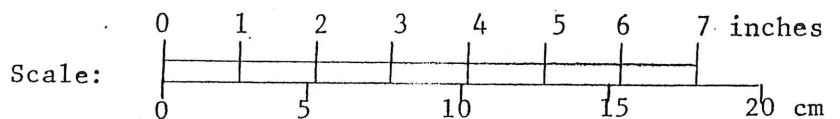
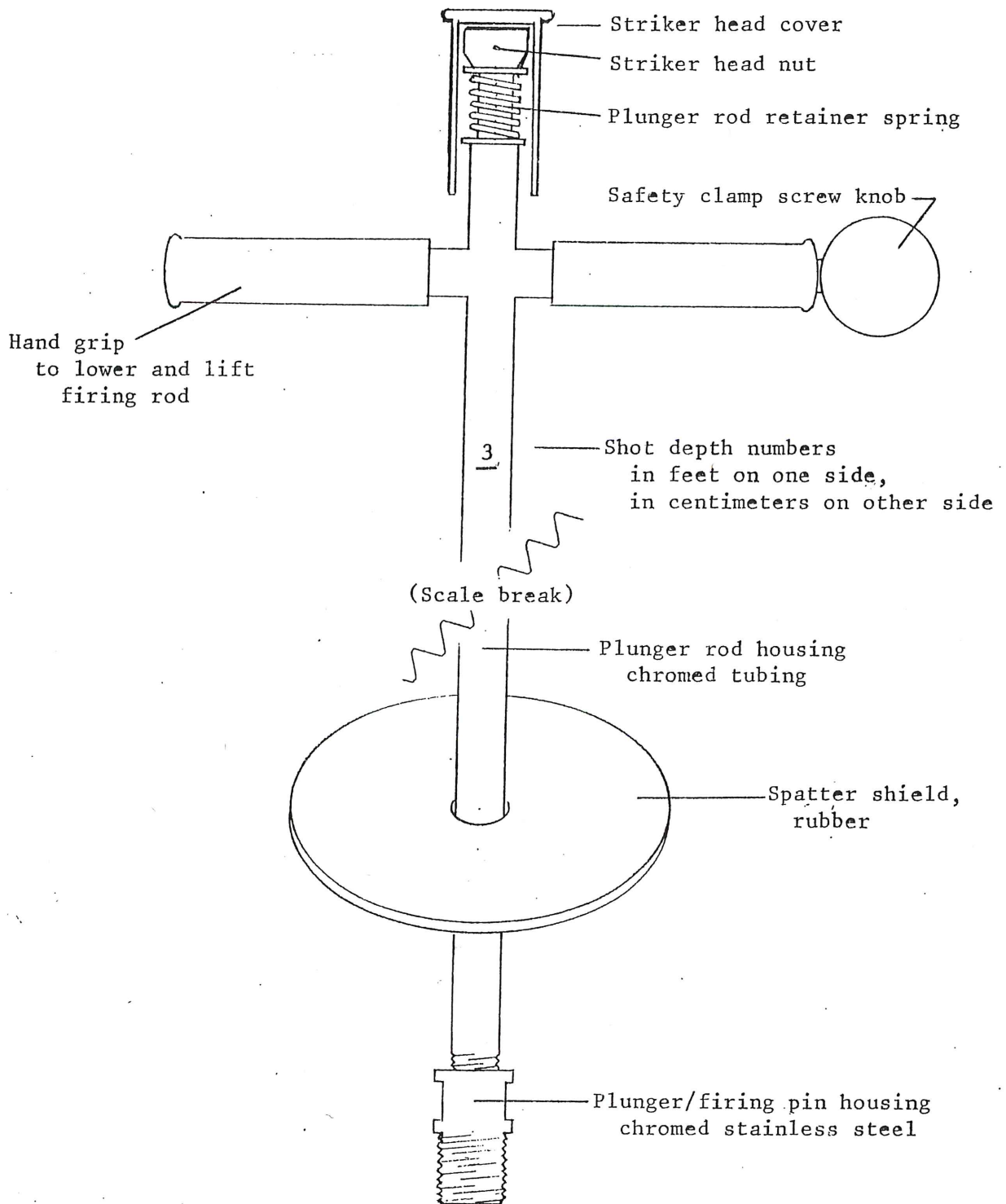
Phone (918) 622-6865  
Fax (918) 664-6262

## REFERENCES

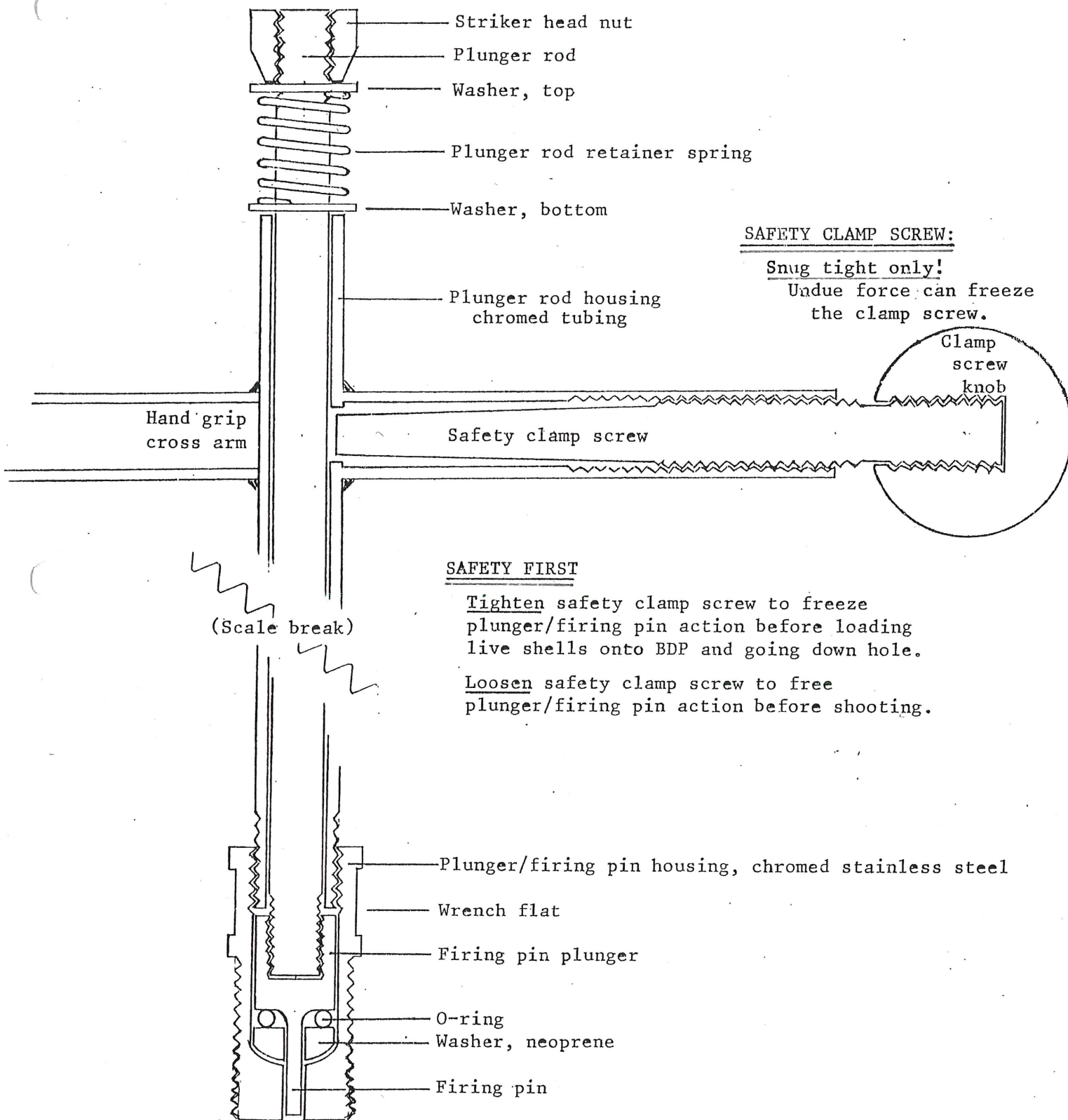
- "Field comparison of shallow seismic sources"  
by Miller, Pullan, Waldner and Haeni  
Geophysics, Vol 51, p 2067-2092, 1986
- "An in-hole shotgun source for engineering seismic surveys"  
by Pullan and MacAulay  
Geophysics, Vol 52, p 985-996, 1987
- "Field comparison of shallow seismic sources near Chino, California"  
by Miller, Pullan, Steeples and Hunter  
Geophysics, Vol 57, p 693-709, 1992
- "Feasibility of CDP reflection to image structures in a 220-m deep,  
3-m thick coal zone near Palau, Coahuila, Mexico"  
by Miller, Saenz and Huggins  
Geophysics, Vol 57, p 1373-1380, 1992
- "A versatile shotgun source for engineering and  
groundwater seismic surveys"  
by Parker, Pelton and Dougherty  
Geophysics, Vol 58, p 1511-1516, 1993
- "Field comparison of shallow P-wave seismic sources near Houston, Texas"  
by Miller, Pullan, Steeples and Hunter  
Geophysics, Vol 59, p 1713-1728, 1994
- "Seismic surveys assess earthquake hazard in the New Madrid area"  
by Williams, Odum, Pratt, Shedlock and Stephenson  
The Leading Edge, Vol 14, p 30-34, 1995
- "Exploring Earth's Shallow Subsurface  
with Geophysical Diffraction Tomography"  
by Alan J. Witten  
Geotimes, Vol 40, No. 1; p 14-17, January 1995
- "Near Surface Geophysics: Special Issue"  
The Leading Edge, Vol. 14, No. 4, April 1995
- "From Camels to Computers: A Short History of Archaeological Method"  
by Thomas E. Levy  
Biblical Archaeology Review, Vol 21, No. 4, p 44, July/August 1995
- "Near Surface Geophysics"  
The Leading Edge, Vol. 16, No. 11, November 1997
- "Shallow VSP work in the U. S. Appalachian coal basin"  
by Lawrence M. Gochioco  
Geophysics, Vol 63, p 795-799, May-June 1988
- "Shallow Seismic Reflection Papers - Special Section"  
Geophysics, Vol 63, p 1210-1434, July-August 1998

Betsy Downhole Percussion (BDP) Firing Rod

U. S. Patent No. 4867266



Betsy Downhole Percussion (BDP) Firing Rod - Enlarged Detail



SAFETY CLAMP SCREW:

Snug tight only!

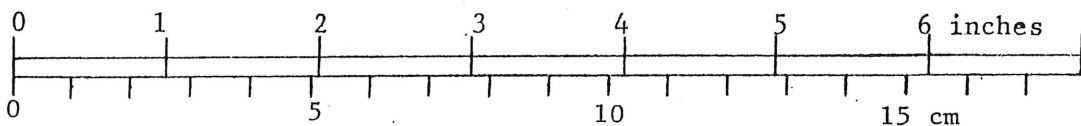
Undue force can freeze  
the clamp screw.

SAFETY FIRST

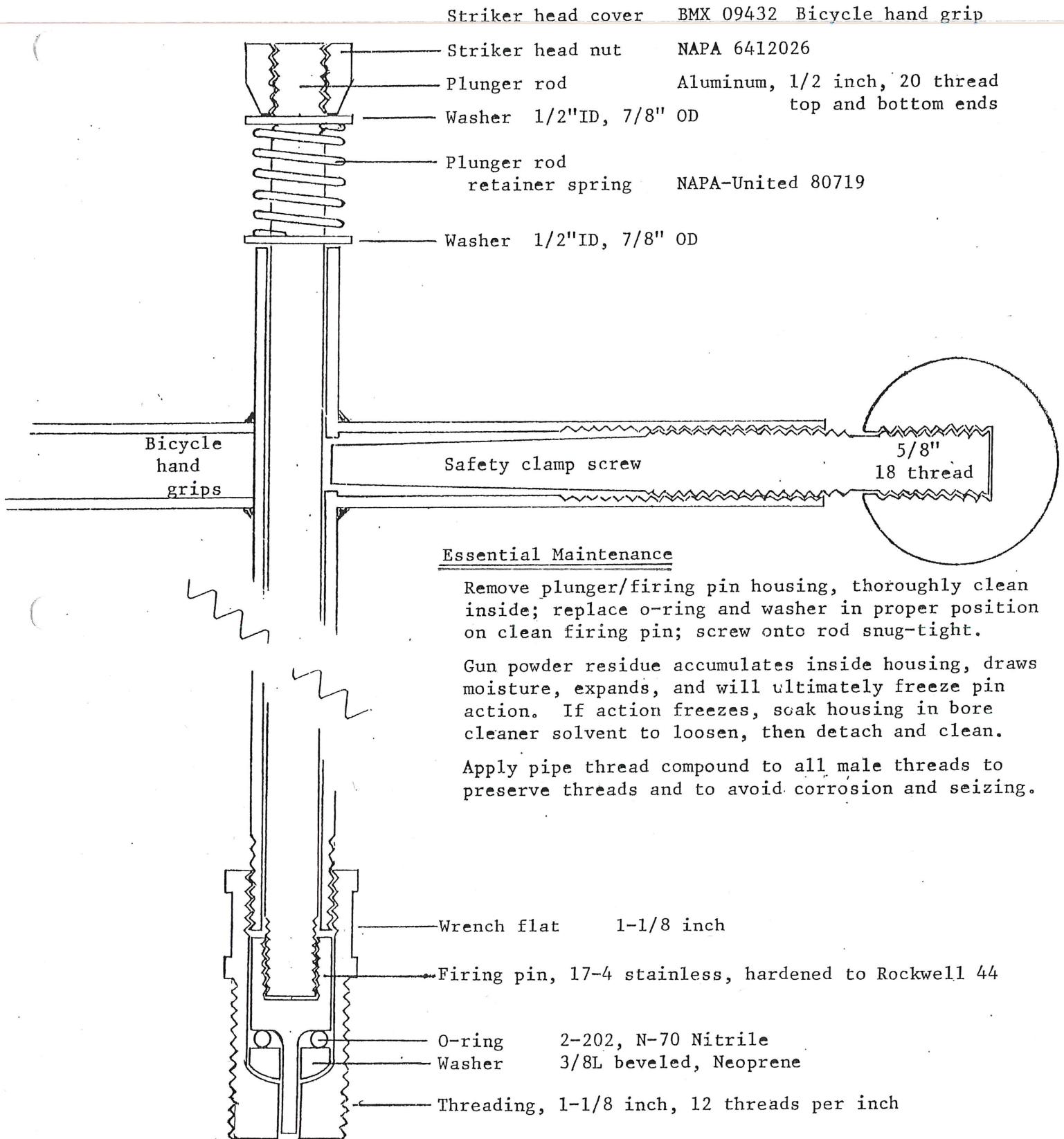
Tighten safety clamp screw to freeze  
plunger/firing pin action before loading  
live shells onto BDP and going down hole.

Loosen safety clamp screw to free  
plunger/firing pin action before shooting.

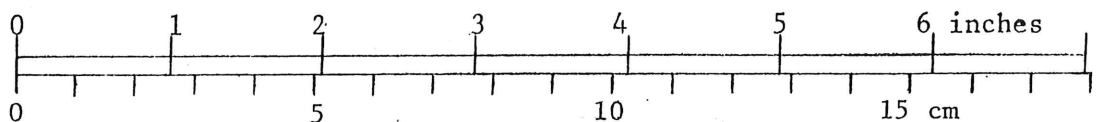
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Betsy Downhole Percussion (BDP) Firing Rod - Parts & Specs



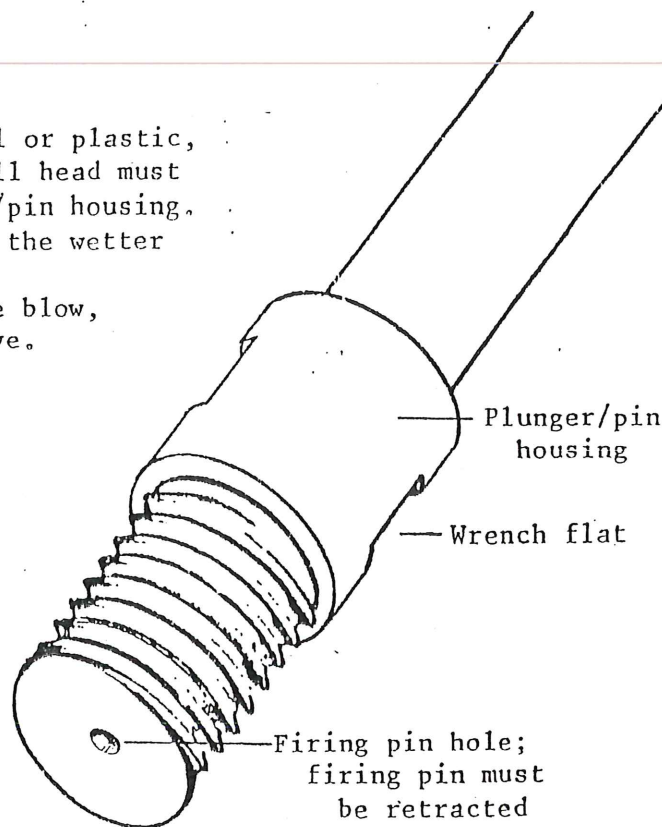
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## Betsy Downhole Percussion (BDP) Firing Rod - Operations & Safety

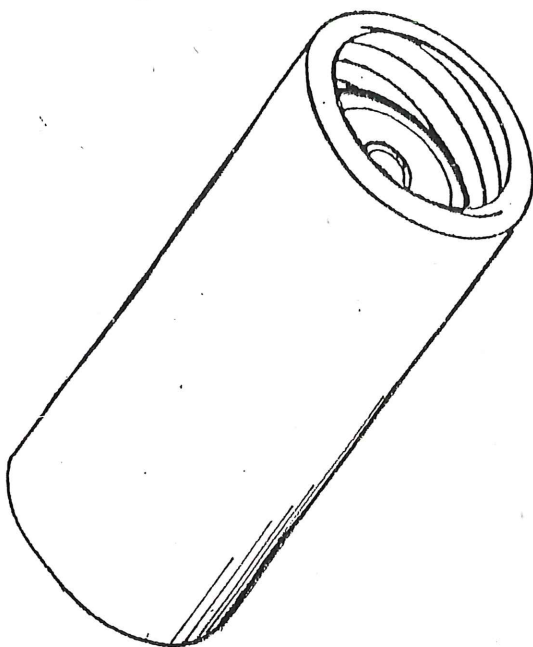
### OPERATION:

1. TIGHTEN safety clamp screw.
2. Screw loaded shell holder, steel or plastic, firmly onto BDP rod bottom; shell head must be in firm contact with plunger/pin housing.
3. Lower rod into hole; tamp hole, the wetter the better.
4. Use hole cover mat to catch hole blow, diminish blast noise and air wave.
5. LOOSEN safety clamp screw.
6. Fire with firm blow of hammer on BDP striker head.



### Shell holder:

Steel: permanent, reusable; 12-gauge or 8-gauge  
Plastic: expendable, fragmented.

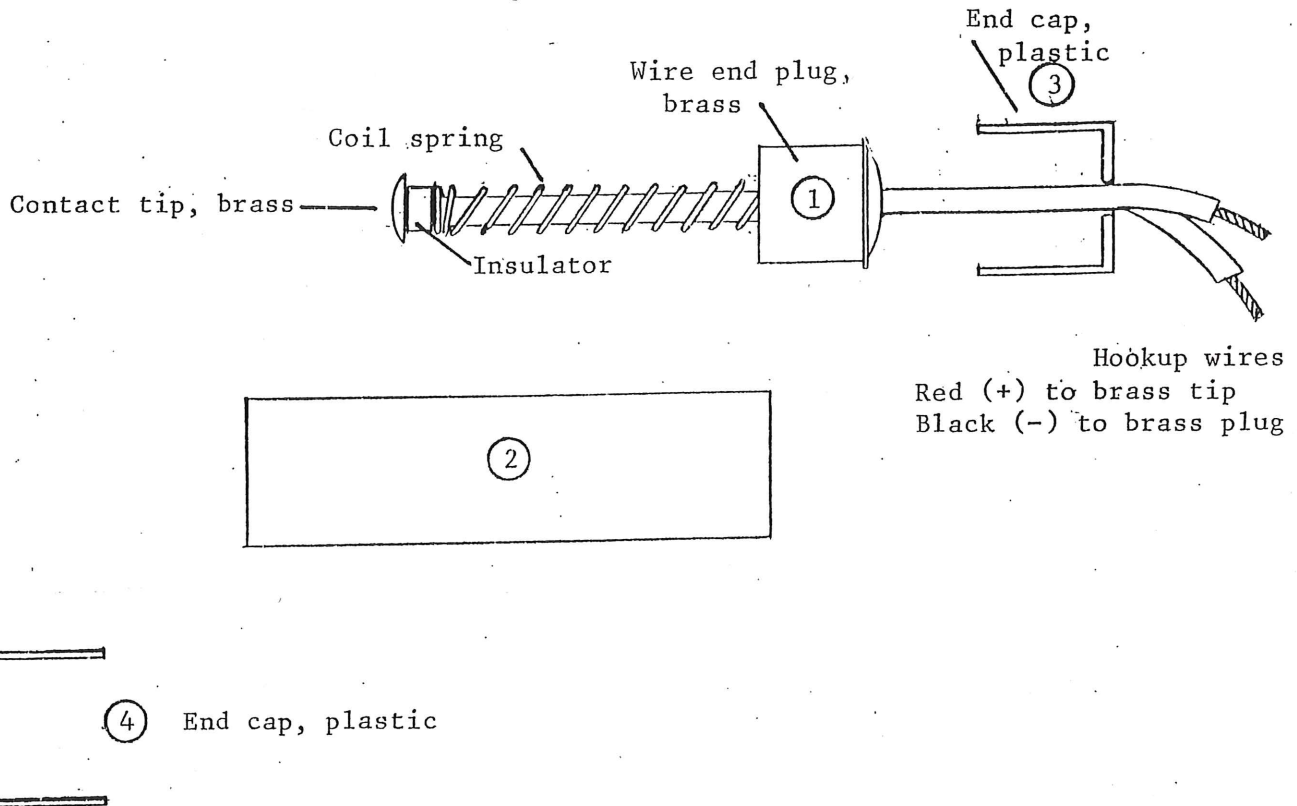


### SAFETY FIRST

- NEVER screw on a live load without first tightening the safety clamp screw to freeze firing pin action.
- NEVER drop, ram or pound on a loaded rod with the safety clamp screw loose, in or out of a shot hole.
- NEVER leave a live load on an unattended rod not in a shot hole or on a rod being transported or stored.
- NEVER retrieve or remove a "no fire" until after at least one minute has passed.
- NEVER detonate a shell above ground.
- NEVER leave fired shell hulls where they might be ingested by, and fatal to, large animals.

BDP SOURCE SENSOR

Horizontal Tube Mount



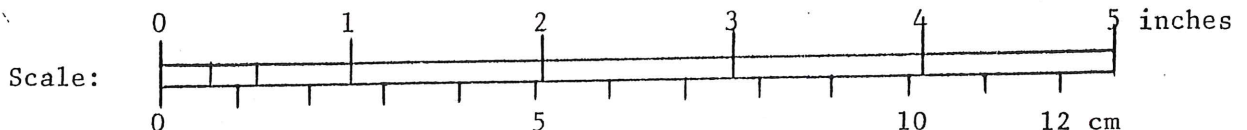
Assembly:

- Part No. 1: Brass end plug: Red wire through coil spring to insulated brass contact tip; wire and spring permanently sealed inside brass end plug with thermosetting plastic.
- 2: Aluminum tube (ground), .75-inch OD x 2.75-inch length.
- 3: End cap, plastic, slips over brass end plug inserted into aluminum tube and slips over aluminum tube; .75-inch ID.
- 4. End cap, plastic, slips over opposite open end of the aluminum tube; .75-inch ID.

Recommended mount: Secured in the horizontal to the under side of one BDP cross arm hand grip. May also be secured to hammer handle.

Secure hookup wires to sensor tube and/or BDP rod to prevent direct pull on the hookup wires.

If the contact tip becomes off center of the tube, the coil spring can be adjusted by slight bending to return the contact tip to center of the tube.



# Betsy Downhole Percussion (BDP) Firing Rod

## General Recommendations

Slim shot holes are recommended for good ground couple; a 1.75 inch/4.5 cm diameter hole will accommodate the BDP steel shell holder or plastic screw-on capsule.

Minimum hole depth of 18 inches/45 cm to top of charge in well tamped hole is recommended. Firm earth or water tamp improves ground couple - the wetter the better.

Hold-down weight, if needed: Hang from BDP hand grip cross arm a bag weighted with sand, soil, rocks or lead shot.

Firm hammer blow is required to fire the percussion shell. A shell primer dented by a weak hammer blow can rarely be fired by subsequent blows.

Hammer switch usually operates better when taped to BDP rod handle rather than to the hammer handle.

Rotate rod only to the right when going in or out of the shot hole. Rotation to the left may unscrew the shell holder.

Hole cover mat up to about 3 ft or 1 meter diameter, of scrap shag rug, astro turf, or similar material, with shag side down, will minimize hole blow debris and noise.

## BDP Firing Rod Maintenance

Clean plunger housing threads with wire brush. Use pipe thread compound on male threads when in use. Cover with thread protector when the firing rod is not in use.

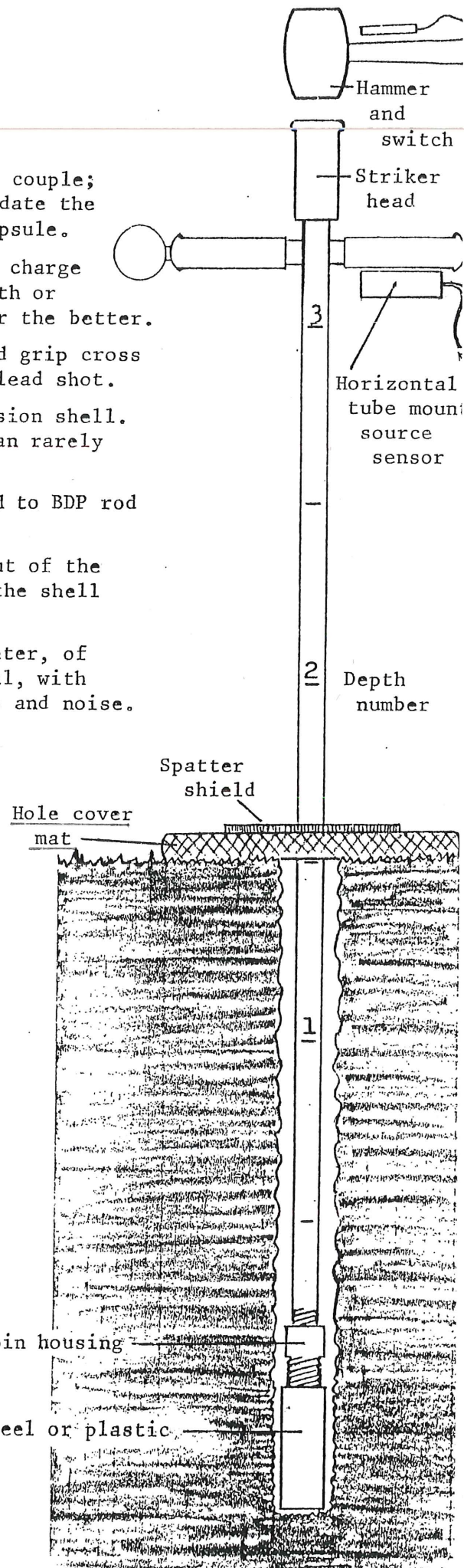
Plunger rod retainer spring and safety clamp screw may be lubricated with white lithium grease or light oil.

Clean inside of plunger/pin housing after each use. Replace o-ring and washer in proper positions to avoid bent firing pin. Apply pipe thread compound to all male threads.

Keep the firing rod and attachments clean and dry. Never put the equipment away wet.

Plunger/firing pin housing

Shell holder, steel or plastic





### SPECIAL INSTRUCTIONS:

SLEDGE HAMMER SWITCHES are often too insensitive for use with the BDP firing rod and dead blow impact hammer.

Either adjust the switch for greater sensitivity or get a new more sensitive switch or other source sensor.

DO NOT USE SLEDGE HAMMER BLOWS on the BDP firing rod which can deform the aluminum plunger rod, strip the plunger rod threads, compact the plunger rod retainer spring and render the firing rod inoperable.

A firm blow with a 1.5 lb dead blow hammer is sufficient to fire percussion shells and should trigger the source sensor for time break.

### DO NOT PUT THE BDP FIRING ROD AWAY WET:

Burnt powder residue + moisture = frozen pin action, even when the firing rod appears dry on the outside. Daily cleaning after use is the best practice.

1. Remove plunger rod/firing pin housing with wrench.
2. Clean and dry firing pin, inside of plunger/pin housing and firing pin hole.
3. Replace o-ring and neoprene washer in proper positions on firing pin.
4. Apply pipe thread compound to firing rod threads.
5. Screw plunger/pin housing back onto firing rod and tighten with wrench.

STANDING AWAY FROM THE SHOT HOLE may be desirable if the hole blow is large particulate matter. A three-foot length of PVC plastic pipe, 2-1/4 to 2-1/2 inch ID, can be slipped over the hammer handle as a handle extension which will allow the firing rod operator to stand some five feet or more away from the shot hole.

### WATERPROOFING SHELLS:

Shot shells with metal head and plastic or paper hulls are most susceptible to water leakage where the metal encircles the hull and through the wad end. Waterproof the shells by (1) greasing the entire shell with white lithium grease, or (2) slip a plastic sandwich bag over the loaded shell holder and secure to the BDP rod bottom with a rubber band or strip of tape.

### HOLD DOWN WEIGHTS:

Any hold down weight, such as a bag weighted with sand, rocks or dirt, should be suspended from the hand grip cross arms as close as possible to the center where the cross arms are joined to the vertical plunger rod housing.

Any weights hung from the outer ends of the hand grip cross arms will eventually bend the arms downward and even break the arms loose from the vertical plunger rod housing pipe.

## SHELF LIFE OF SHOT SHELLS

### Temperate Zones:

Under normal clean, dry and ventilated temperate storage conditions, shot shells will remain usable from ten to twenty years.

### Tropic Zones:

Under constant high humidity, near and above the 80% range, the propellant charge could deteriorate in a few months. A dehumidifier in the shell storage is recommended.

### Torrid Zones:

Under constant high temperatures of 120°F/50°C or higher, the primer material could deteriorate in a few months. Shaded, well ventilated shell storage is recommended.

### Frigid Zones:

Under constant low temperatures of -40°F/-40°C and lower, no deterioration of primer material or propellant charge, but the powder burn rate will be slowed, yielding low pressure detonations and possible no-fires. Warm shell storage is recommended. In the field, shells should be kept warm in vehicle units or in pockets under outer garments.

## SHELL STORAGE

Store shells in clean, dry area, preferably under lock and key, well away from flammable liquids or solids, oxidizing materials, high voltage wires, hot pipes, ducts or machinery or welding equipment.

In storage, transport, or in the field, keep shells clean and dry and well protected from spillage of gasoline, diesel fuel, light oils, solvents or other similar penetrating fluids. DO NOT USE SHELLS SOAKED BY ANY SUCH FLUIDS.

## SHELL CLASSIFICATION: RESTRICTED ARTICLES, DANGEROUS GOODS

Via UPS ground: Box markings and shipping record:  
SMALL ARMS AMMUNITION, ORM-D  
Maximum weight per box: 65 lbs gross

Via Fedex Air : Box markings and shipping record:  
CARTRIDGES, SMALL ARMS, ORM-D-AIR  
Blanks: 1.4S Label, UN0014, Pkg 130, PG II  
Projectiles: 1.4S Label, UN0012, Pkg 130, PG II  
Maximum weight per box: 55 lbs/25 kgs net  
Authorization: Remington shells: USDOT CA-860520  
Winchester shells: USDOT CA-860549

U. S. Dept. of Commerce Commodity No. 9306.90.0040 5  
(Betsy shells) "other ammunition and projectiles" (NOT FOR WEAPONS)

U. S. Dept. of Commerce Commodity No. 9015.90.0000 5  
(BDP Firing Rods) "geophysical instruments and appliances,  
(Betsy M3's) parts and accessories"

BLANK ENERGY - EXPLODED SHELL

FFFFg (4Fg) Black Powder Charge:

<u>Grains</u>	<u>Ounces</u>	<u>Grams</u>	<u>Calories</u>	<u>Ft-lbs</u>	<u>Joules</u>
150	.343	9.72	6,590	20,363	27,591
200	.457	12.96	8,787	27,152	36,789
250	.571	16.20	10,984	33,941	45,988
300	.686	19.44	13,180	40,726	55,182
350	.800	22.68	15,377	47,515	64,380
400	.914	25.92	17,574	54,304	73,578
437.5	1.000	28.35	19,221	59,393	80,474
500	1.143	32.40	21,967	67,878	91,971

(500 grains is the legal maximum load for SMALL ARMS AMMUNITION)

FFFFg (4Fg) Lab Test Data:

Composition: 75% Potassium Nitrate, 15% Charcoal, 10% Sulphur

Auto-ignition: 500°F, 260°C

Maximum temperature: 3014°Kelvin

Heat of combustion: Theoretical maximum: 726 calories per gram  
Actual test range : 665 to 690 cal/gram  
Average in use : 678 calories per gram

Propagation velocity: 1850 ft/sec, 549 meters/sec

Peak pressure, 80 grains in closed chamber: 15,000 psi

Time to peak: .001 sec

Black powder grades are Fg (coarse), FFg (fine), FFFg (finer), and FFFFg (4Fg - finest). 4Fg is used for BSI seismic blanks because it weighs heavier by volume than the coarser grades. 4Fg black powder is an explosive, burns completely under minimal confinement and is the most suitable for seismic blanks.

Propellant charges in projectile shells will not release maximum energy from complete burn except in severe confinement down the length of a gun barrel. Propellant energy is largely consumed in driving the projectile down the barrel. Projectile shells fired in no-barrel devices yield little energy as the shell primer usually blows the projectile and unburned propellant out the muzzle at low velocity.

Propagation or explosion velocity of 4Fg black powder, about 1850 ft/sec or 549 meters/sec, induces a higher conversion of energy into elastic radiation than an equivalent charge of higher velocity explosives. As a rule, the higher the propagation velocity, the higher the loss of energy in the useful seismic band, depending on charge size, charge depth and the nature of the surrounding medium.

FFFFg (4Fg) BLACK POWDER ENERGY

4Fg Energy:

Load charge in grams x calories per gram = Total Calories

Total Calories x 3.09 = Energy in ft-lbs

Total Calories x 4.1868 = Energy in joules

Conversions:

4Fg black powder average heat of combustion: 678 calories/gram

15.43 grains = 1 gram

437.5 grains = 1 ounce = 28.35 grams

Comparisons: 1 grain, 4Fg black powder : 136 ft-lbs, 184 joules  
1 grain, 60% nitro dynamite: 170 ft-lbs, 230 joules

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Data Sources:

U. S. Arsenal, Dover, NJ  
GOEX Inc., Explosives Div., Moosic, PA  
Hercules Powder Co., Kenvil, NJ  
Hodgdon Powder Co., Shawnee Mission, KS  
Winchester Div., Olin Corp., East Alton, IL  
Remington Arms Co., Lonoke, AR

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**Material Safety Data Sheet**

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

**U.S. Department of Labor**

Occupational Safety and Health Administration  
(Non-Mandatory Form)  
Form Approved  
OMB No. 1218-0072



**IDENTITY (As Used on Label and List)**  
All Shotshell Ammunition

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

**Section I "Small Arms Ammunition"**

Manufacturer's Name Remington Arms Co., Inc.	Emergency Telephone Number (501) 676-3161
Address (Number, Street, City, State, and ZIP Code) I-40 & Highway 15 Lonoke, Arkansas 72086	Telephone Number for Information (501) 374-2246
	Date Prepared 8-12-86
	Signature of Preparer (optional) W.G. Bell, Chem Lab - Technical Section

**Section II -- Hazardous Ingredients/Identify Information**

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Lead, inorganic and lead compounds	50mg/M <sup>3</sup>			
Arsenic and compounds	10mg/M <sup>3</sup>			
Antimony and compounds	500 mg/M <sup>3</sup>			
Barium and compounds	500 mg/M <sup>3</sup>			
Nitroglycerin (0.05 ppm skin) 500 micrograms/M <sup>3</sup> of air				

DOT - "Small Arms Ammunition"  
Class C Explosive

UPS ORM-D

**Section III -- Physical/Chemical Characteristics**

Boiling Point Not applicable	Specific Gravity (H <sub>2</sub> O = 1) Not applicable
Vapor Pressure (mm Hg) Not applicable	Melting Point Not applicable
Vapor Density (AIR = 1) Not applicable	Evaporation Rate (Butyl Acetate = 1) <b>NOT APPLICABLE</b>
Solubility in Water Lead & Lead Styphnate - Insoluble; Lead Nitrate - 127 gm/100cc Water - 100°C	
Appearance and Odor Grayish, Gray, Silvery Material - No odor	

**Section IV -- Fire and Explosion Hazard Data**

Flash Point (Method Used) Not applicable	Flammable Limits Not applicable	LEL NA	UEL NA
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Extinguishing Media  
Material is self oxidizing; flood with water to fight fire and cool shells.

Special Fire Fighting Procedures  
Evacuate immediate area and deluge with water, wear protective clothing for shrapnel.

Unusual Fire and Explosion Hazards  
Shells will detonate when exposed to flame and high temperatures.

**Section V -- Reactivity Data**

Stability	Unstable		Conditions to Avoid Flames, sparks, percussion or shock and high temperatures (130°C)
	Stable	X	

Incompatibility (Materials to Avoid) Strong mineral acids and alkalis

Hazardous Decomposition or Byproducts Oxides of carbon, nitrogen and lead fumes.

Hazardous Polymerization	May Occur		Conditions to Avoid Heat, fire, static, friction and percussion.
	Will Not Occur	X	

**Section VI -- Health Hazard Data**

Route(s) of Entry: Inhalation? Fumes Skin? Cuts or abrasions - Particles

Health Hazards (Acute and Chronic)  
Anemia, fatigue, nocturia, embryotoxin, malnutrition, weakness, mental confusion, pallor  
treat per general lead exposure; headache and nausea

Carcinogenicity: Not known NTP? IARC Monographs? OSHA Regulated? Lead - Yes

Signs and Symptoms of Exposure Refer to health hazard above.

Medical Conditions Generally Aggravated by Exposure Gastrointestinal tract; kidneys, blood and central nervous system. (CNS)

Emergency and First Aid Procedures Skin - flush with water; if swallowed seek medical attention immediately.

**Section VII -- Precautions for Safe Handling and Use**

Steps to Be Taken in Case Material is Released or Spilled

Use non-sparking equipment to cleanup and store shells - avoid ignition sources.

Waste Disposal Method Material may be burned per appropriate federal, state and local regulatory agency contact

Precautions to Be Taken in Handling and Storing

Refer to released or spilled data above.

Other Precautions

Label containers - "Small Arms Ammunition" wear gloves and shrapnel protection.

**Section VIII -- Control Measures**

Respiratory Protection (Specify Type) OSHA SA/HiE/SCBA

Ventilation	Local Exhaust	Not required	Special	Not applicable
	Mechanical (General)	Not required	Other	Not applicable

Protective Gloves Not applicable Eye Protection Safety glasses when shooting

Other Protective Clothing or Equipment Use hearing protection when discharging cartridges.

Work/Hygiene Practices Wash hands after skin contact with cartridges.



TRANSMITTAL - PACKING LIST

From: Betsy Seisgun Inc.  
7739-D East 38th St.  
Tulsa, OK 74145 - 3222

To: UNIVERSITY OF TEXAS AT EL PASO  
CENTRAL RECEIVING WAREHOUSE  
3120 SUN BOWL DRIVE  
EL PASO, TX 79902  
PO-724-2000A01619 WELXM

INDUSTRIAL SEISMIC TOOL, ACCESSORIES  
AND SPARES, KIT AND CASE

Piece

Contents

- |                                 |   |
|---------------------------------|---|
| 1. carton<br>29 lbs<br>53x17x5" | <ul style="list-style-type: none"> <li>1 - Carrying case, Contico, 52x13x4" black plastic; 4 latches, 2 lock studs; foam cushion interior containing the following:</li> <li>1 - Betsy Downhole Percussion (BDP) firing rod No. 207; chromed pipe with depth marks and numbers in ft and cm; safety clamp screw and knob; head cover, hand grips, spatter shield, thread protector (NOT A FIREARM)</li> <li>1 - Shell holder No. 217 (12), stainless steel, knurled finish; permanent screw-in 12-gauge bushing insert installed</li> <li>1 - Dead blow hammer, 1.5 lbs</li> <li>1 - Ejector rod, .75x12" wood, leather thong</li> <li>1 - Source Sensor No. 53, aluminum tube, horizontal mount, wired</li> <li>1 - Wrench, 1-1/8" open end (for plunger/pin housing)</li> <li>1 - Brush, fiber bristle, plastic handle (thread cleaner)</li> <li>1 - Brush, nylon bristle, round, wire handle (shell holder cleaner)</li> <li>1 - Grease, white lithium, tube</li> <li>1 - Pipe thread compound, tube</li> <li>1 - Shop cloth</li> <li>2 - O-ring, 2-202, N70 Nitrile (spares)</li> <li>2 - Washer, 3/8L beveled, Neoprene (spares)</li> <li>1 - Spring, NAPA-United 80719 (spare)</li> <li>1 - Tote bag, Sturm, flap &amp; strap</li> <li>1 - Field Manual</li> </ul> <p>Extra Equipment:</p> <ul style="list-style-type: none"> <li>1 - Shell holder No. 218 (8), stainless steel, knurled finish; permanent screw-in 8-gauge bushing insert installed</li> </ul> |
|---------------------------------|---|

Shipment: 1 piece/29 lbs, 28 Sept 1999  
Via: UPS, prepaid  
P.O: PO-724-2000A01619 WELXM

By: *Wesley D. Martin* 28 Sept 99

**BETSY SEISGUN INC.**  
P.O. Box 471143 Phone (918) 622-6865  
Tulsa, OK 74147-1143 USA Fax (918) 664-6262

Received by: \_\_\_\_\_

Date: \_\_\_\_\_

PRICE SCHEDULE - BETSY DOWNHOLE PERCUSSION (BDP) FIRING ROD - 1 JAN 1997

All prices FOB Tulsa

Terms: Net cash, 30 days

BDP Firing Rod, Kit and Case ..... \$ 900.00

- 1 - Carrying case, high impact hard plastic, 52x13x4 inches, 132x33x10 cm, four latches, two lock studs; foam cushion interior containing the following:
  - 1 - BDP firing rod, chromed pipe with depth marks and numbers in feet (to 3 ft) and centimeters (to 90 cm); safety clamp screw and knob; plunger/firing pin housing with thread protector; striker head cover, hand grips, spatter shield. Complete and assembled. Accommodates screw-on steel shell holder or screw-on PVC encapsulated blank shells.
  - 1 - Shell holder, stainless steel, knurled finish; four inches/ten centimeters length, 1-5/8 inches, 4 centimeters OD, with permanent bushing insert of either 12-gauge or 8-gauge size.
  - 1 - Dead blow impact hammer, 1.5 lb/.7 kg
  - 1 - Ejector rod, 12 inches/30 cm, wood, leather thong
  - 1 - Wrench, 1-1/8 inch, open end, for plunger/firing pin housing
  - 1 - Brush, wire bristle, thread cleaner
  - 1 - Brush, nylon bristle, shell holder cleaner
  - 1 - Grease, white lithium, tube
  - 1 - Pipe thread compound, tube
  - 1 - Shop towel
  - 2 - O-ring, 2-202, N70 Nitrile (spares)
  - 2 - Washer, 3/8L beveled, Neoprene (spares)
  - 1 - Spring, NAPA-United 80719 (spare)
  - 1 - Tote bag
  - 1 - Field Manual

BDP Kit and Case shipping weight: 24 lbs/11 kgs

BDP SPARE PARTS

Shell holder, stainless steel, knurled finish, with permanent 12-gauge or 8-gauge bushing insert, each .....	\$ 175.00
Plunger rod, aluminum, 1/2x41.5 inches, 20 thread, each .....	19.00
Spring, plunger rod retainer, NAPA-United 80719, each .....	1.50
Washer, plunger rod, 1/2 inch ID, flat steel, HBW-87A .....	.85
Striker head nut, NAPA 6412026, each .....	1.00
Striker head cover, CPC-09432, each .....	5.50
Plunger/firing pin housing, stainless steel, each .....	88.00
Firing pin, tempered stainless, each .....	42.00
O-ring, 2-202, N70 Nitrile, each .....	.50
Washer, 3/8L beveled, Neoprene, each .....	.50
Thread protector, 1-1/8 inch ID cup, each .....	1.00
Spatter shield, each .....	6.00
Hand grips, pair .....	\$ 7.50

Address all orders to: BETSY SEISGUN INC.  
P.O. BOX 471143  
TULSA, OK 74147 - 1143  
Phone: 918-622-6865  
FAX: 918-664-6262



BDP RENTAL (U.S.A. Only)

BDP Firing Rod, kit and case, as listed on the Price Schedule, including one steel shell holder of one shell size: \$300.00 per month, one month minimum. Rental may be applied to purchase if renter opts to retain possession of the BDP kit and case.

Renter pays transportation costs from and return to Tulsa and is responsible for any loss or damage other than that due to normal field use. Terms: Net cash, 30 days.

Address all return shipments to: BETSY SEISGUN INC.  
7739-D EAST 38TH ST.  
TULSA, OK 74145

OPTIONAL EQUIPMENT - HAND AUGER

All steel, hand operated earth auger digs 2 inch/5 centimeter hole to 3 ft/1 meter depths. Overall length: 42 inches/107 cm. Weight: 7 lbs 3 kgs

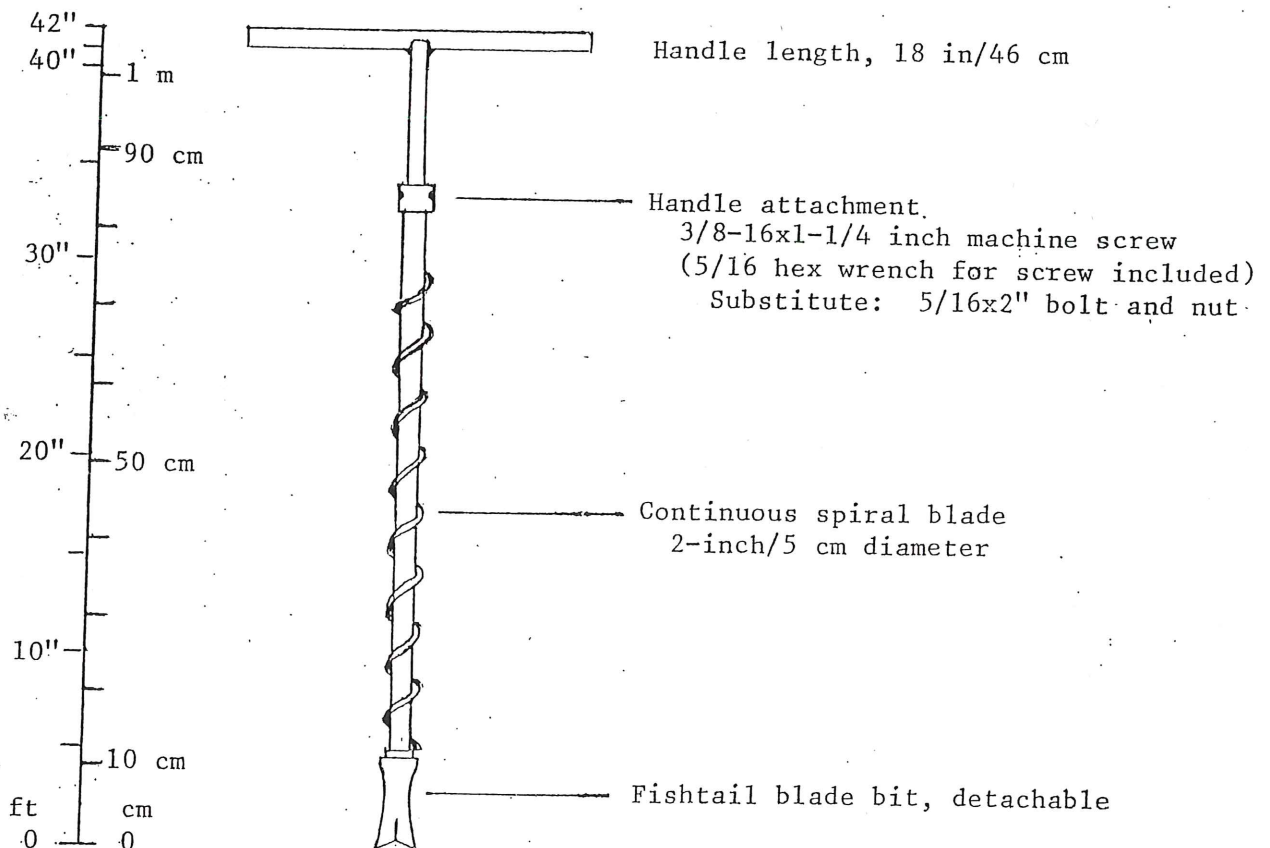
Fishtail 2 inch/5 cm bit is detachable, replaceable.

Continuous spiral blade is 25 inches/64 centimeters long.

Handle attachment is detachable for shipping.

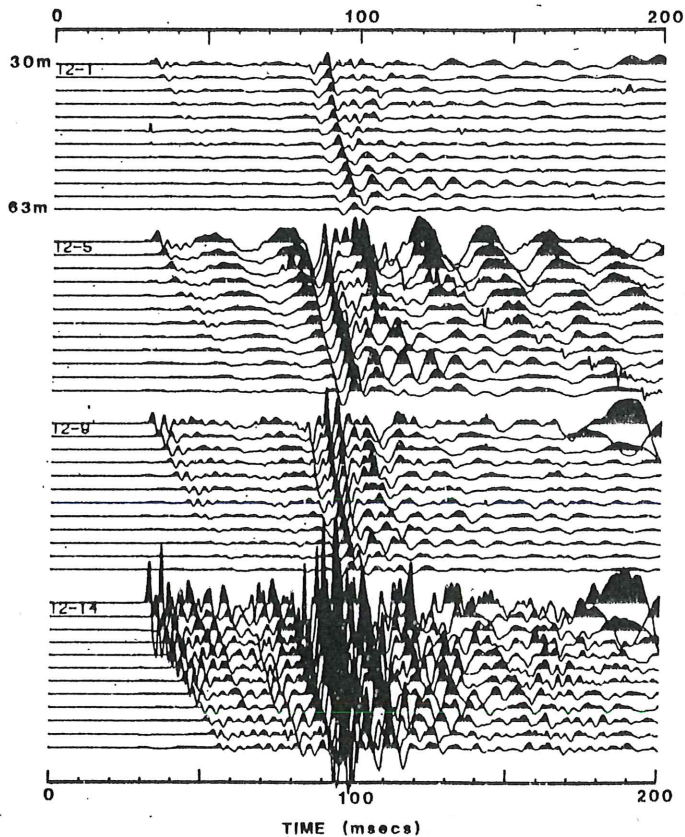
Purchase: \$195.00 FOB Tulsa

Rental: \$75.00 per month.



In-hole Shotgun Source

SOURCE TEST - RAMSAYVILLE, ONT



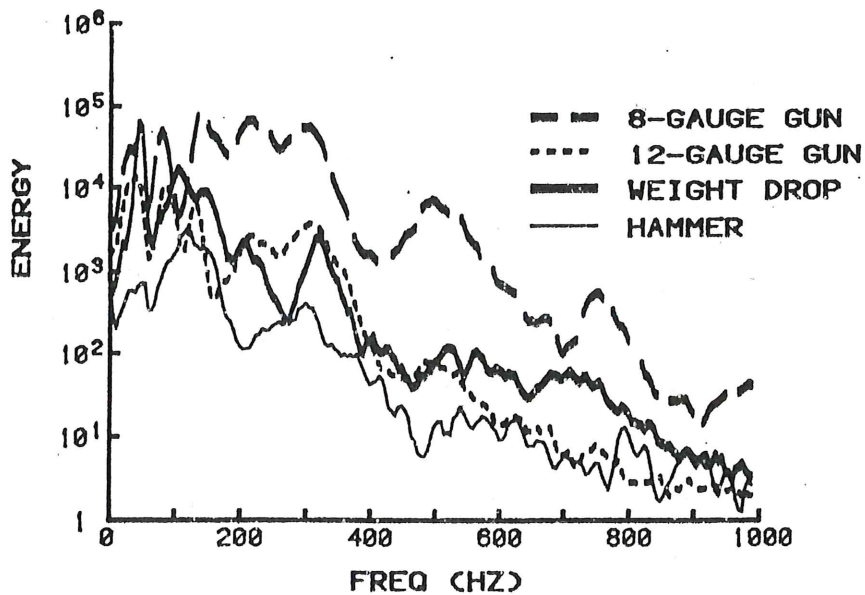
ALL PASS  
100 Hz PHONES

HAMMER (16 lbs/7.3 kgs)

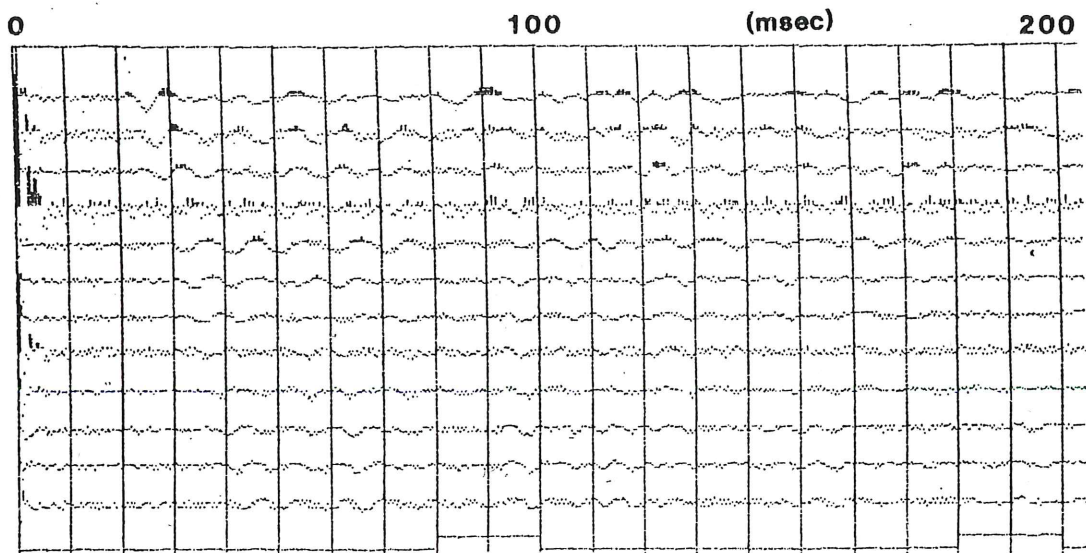
WEIGHT  
DROP (165 lbs/75 kgs)

12-GAUGE (165 grains)  
"BUFFALO GUN"

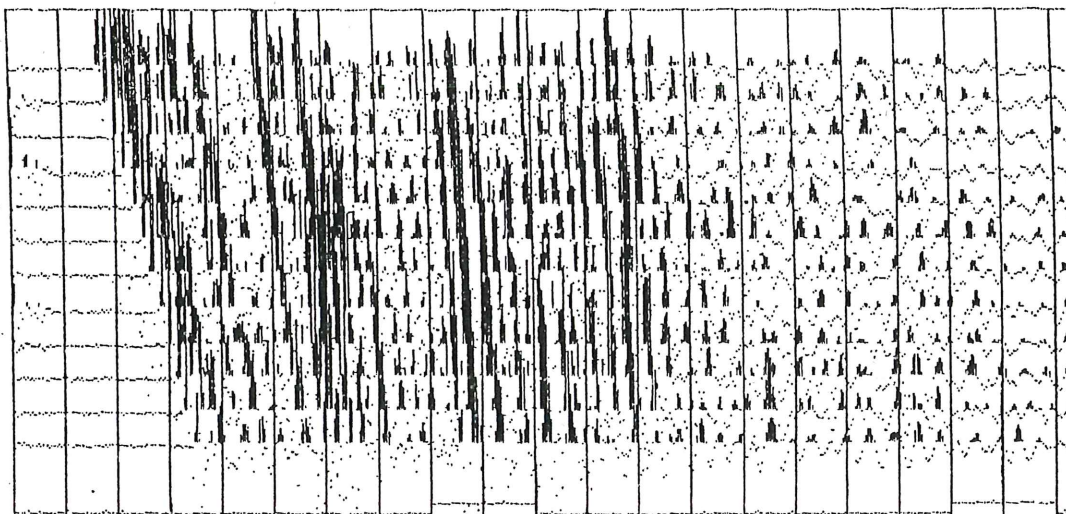
8-GAUGE (300 grains)  
"BUFFALO GUN"



Results of a source test conducted at Ramsayville, Ontario, with 100 Hz geophones and the analog filters on the seismograph set at all-pass.



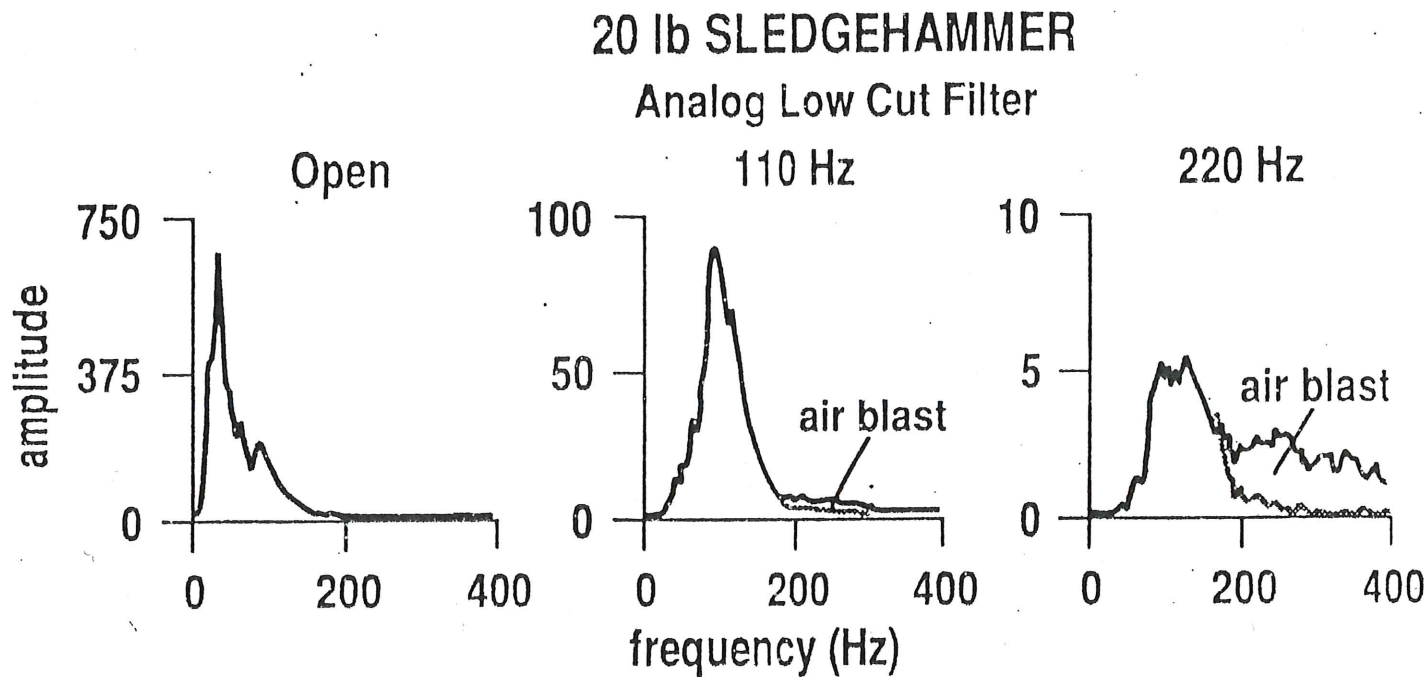
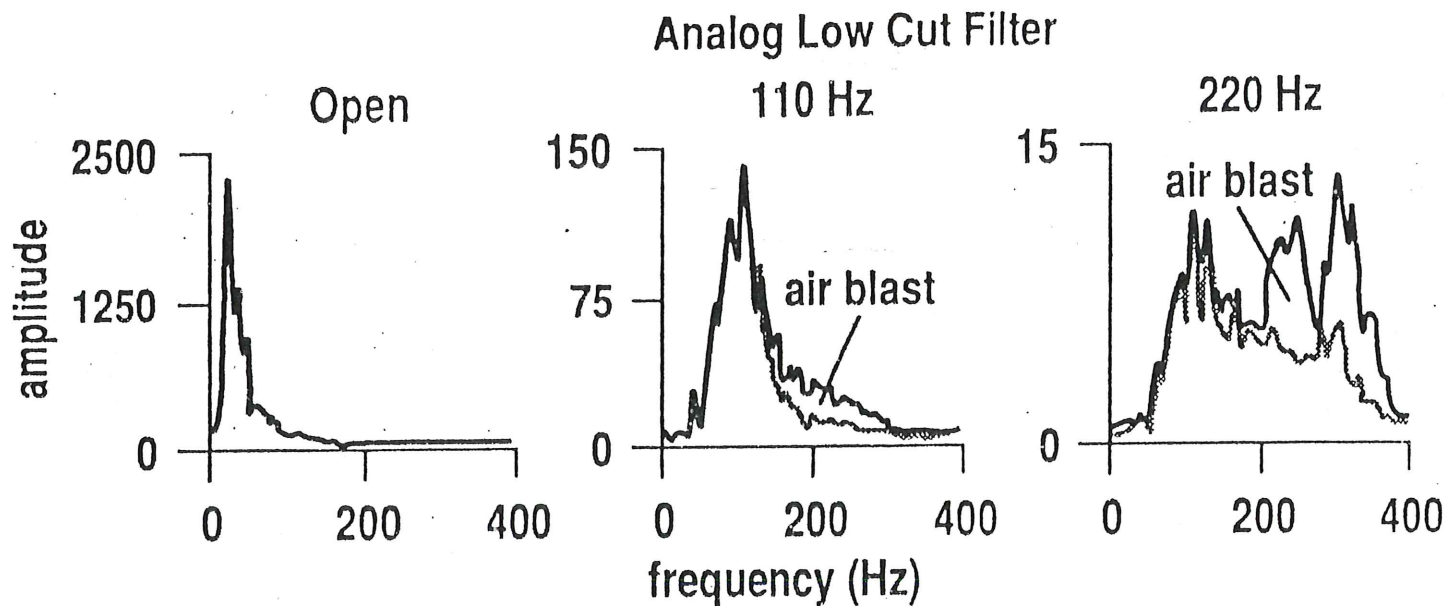
**12-GAUGE "BUFFALO GUN" (2 stacks) SHOT IN DRY ROAD BED**



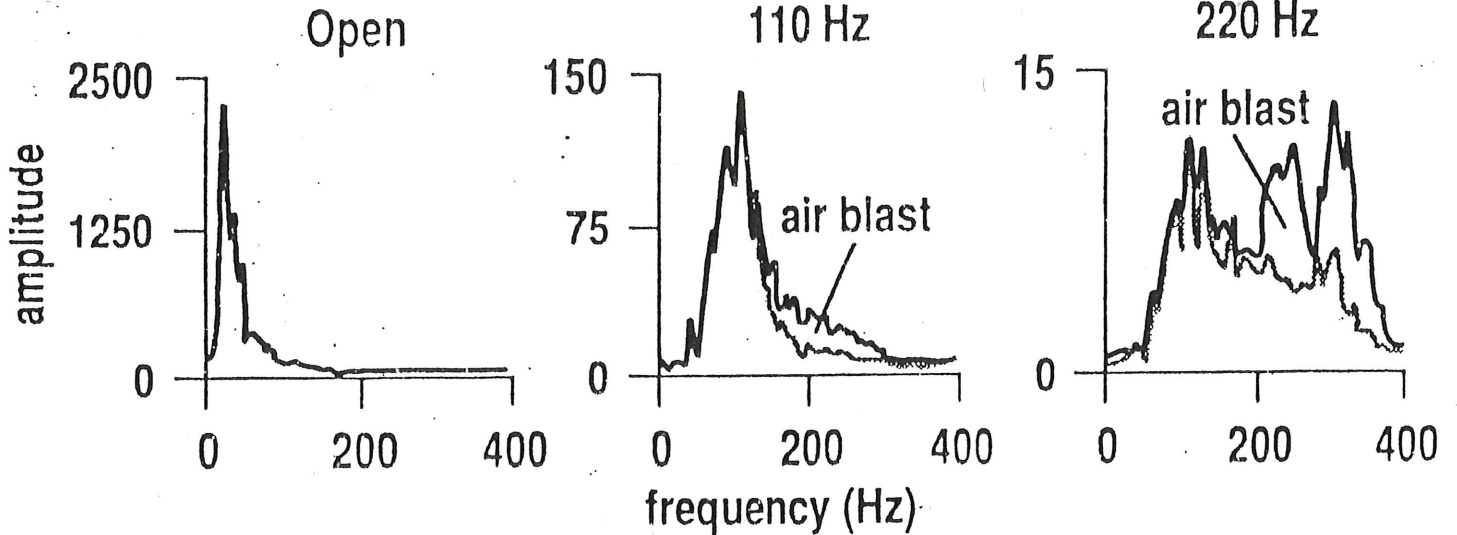
**12-GAUGE "BUFFALO GUN" (1 stack) SHOT IN WATER FILLED DITCH (165 grains)**

Two field records obtained by shooting into the same geophone spread in the Fraser delta area near Vancouver, British Columbia.

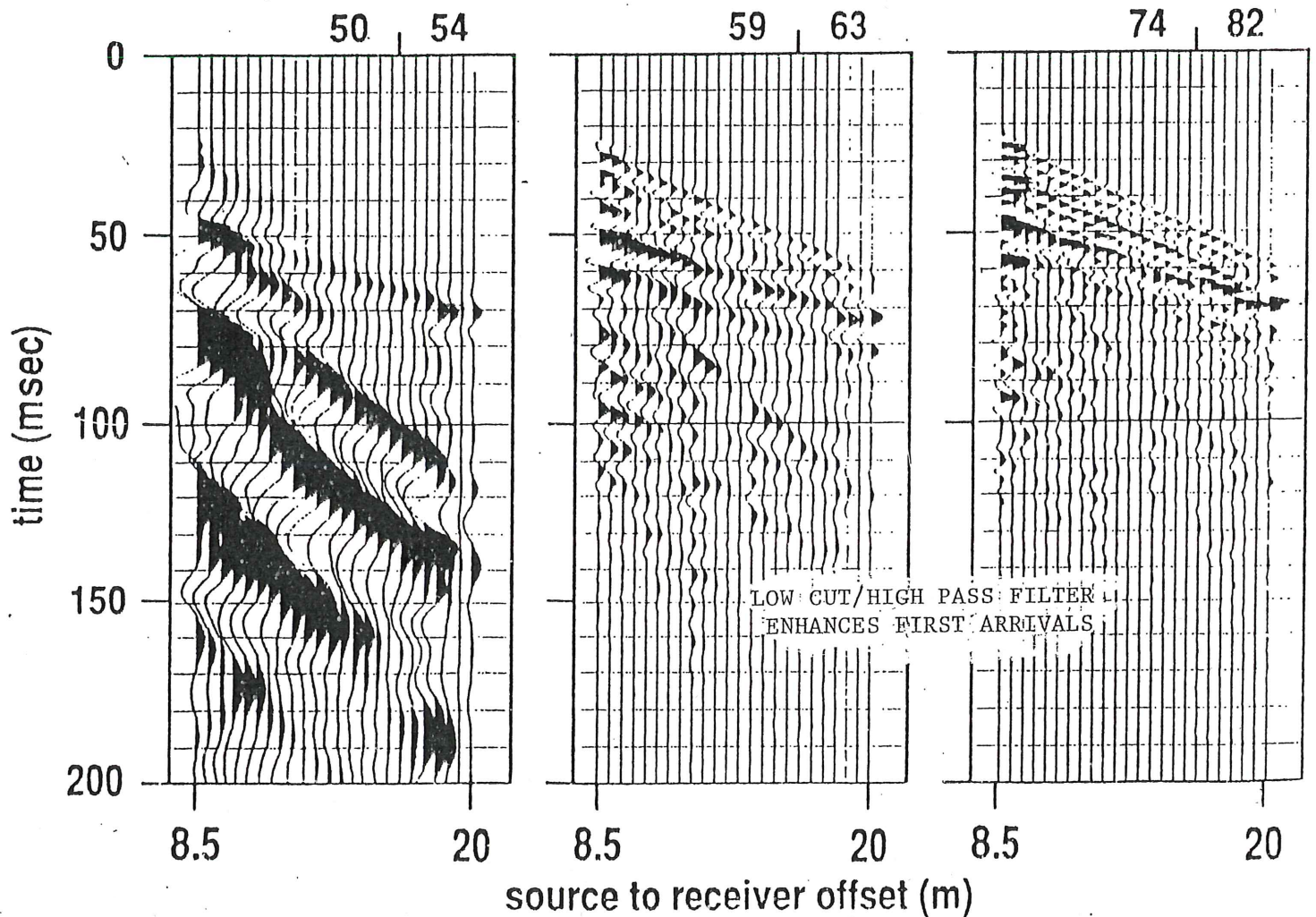
(Geological Survey of Canada)



Analog Low Cut Filter



total gain applied individually to each trace (dB)



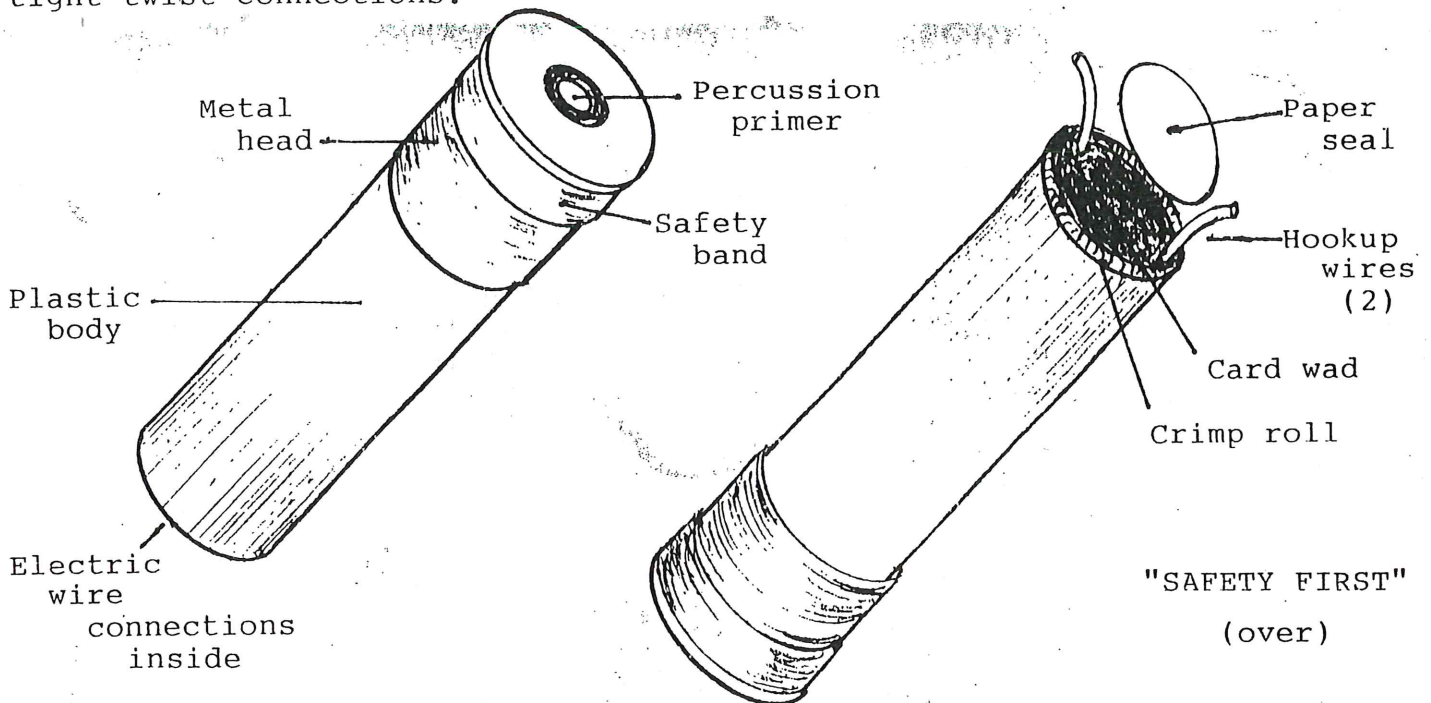
P&E shell : 8-gauge industrial, high brass head, plastic body  
Head rim OD: 1 inch/25 mm  
Brass length: 7/8 inch/22 cm. Total length: 3 inches/76 mm  
Load capacity: 400 grains 4Fg black powder

Percussion : Standard Remington center-fire percussion primer.

Electric AC: Carbon film resistor is sealed inside bottom end of the shell under a card wad, paper seal and body crimp. This resistor is unaffected by humidity and operates in a temperature range of -67°F to 310°F, -55°C to 155°C. It cannot be ignited by heat, friction, impact, static electricity or radio signal.

Power supply: 110 VAC, 60W or higher, from utility lines or 12-volt DC to 110-volt AC inverter. One outlet inverters that plug into auto cigarette lighter sockets work well with a rated output of 110 VAC, 70 to 100W, 60 Hz.

Wire hookup: Remove paper seal on shell bottom to access two half-inch bare hookup wires. Do not remove card wad or crimp seal. Small needle-nose pliers are recommended to remove paper seals and make tight twist connections.



"SAFETY FIRST"  
(over)

## SAFETY FIRST

NEVER hook up electric shells until the firing line is disconnected from the power supply and shorted out.

NEVER retrieve a "no fire" until at least one minute has passed.

NEVER leave shell hulls where they could be ingested by, and fatal to, large animals.

NEVER forget the shock danger of high wattage 110 VAC, especially in damp to wet field conditions.

NEVER use small gauge, high resistance speaker type wire for firing line. Use common lamp cord, two conductor, multiple copper strands.

-----

## SURE FIRE MULTIPLE BLANKS

WIRE ONE P&E blank for electric detonation. Bind one or more blanks to the wired blank with vinyl tape. Severe confinement in a metal can or glass jar, buried and tamped, guarantees simultaneous detonation of all the bundled blanks. A small slit in the shell hulls aids propagation.

## WATER PROOFING

Grease the shell with white lithium grease and wrap the greased shell tightly in a plastic sandwich bag.

Galen:

Re: Shot boosters

Some P&E users report using volatile liquids in the shot hole with a P&E shell to increase energy output at low cost.

Gasoline, kerosene and diesel have been used but apparently the best is "quick start" which is ether based, extremely volatile, evaporates quickly, comes in a pressurized can and is intended for quick starting gasoline engines with a quick squirt on the air intake filter.

The best results, as described to me were achieved by:

1. Wadding up coarse paper **towels**
2. **Stuff the** wad into a zip-lock plastic bag
3. Soak the wad with **quick start**, quickly
4. Close the bag tight and plant it with **the charge**
5. Tamp the shot hole; the firmer the better; **some users** place a hold-down weight over the hole ... a two or three foot round cut of plywood or **solid** steel grill with a rope or chain attached so it can **be** dragged, not carried ... some say they stand on the cover for extra hold-down weight ... (if you do so, bend your knees, they advise.) Whatever ... DO BE CAREFUL!

--- phil



# INVOICE

Remit to: **BETSY SEISGUN INC.**

P.O. Box 471143  
Tulsa, OK 74147-1143 U.S.A.  
Phone (918) 622-6865

Invoice No.: BSI-1519  
Date: 30 Sept 2015  
Terms: Net Cash, 30 Days

IRS TIN No. 73-1196185

To: University of Texas at El Paso  
Dept of Geological Sciences  
500 West University  
El Paso, TX 79902

Attn: Galen Kaip/Accounts Payable; FAX #915-747-5073

Item	Description	Amount
1.	Freight: UPS charge for shipment of the following items, Tulsa to El Paso, prepaid .....	\$ 25.00
2.	Remington R8BL/400BP, 8-gauge industrial percussion blank with 400-grain 4Fg black powder load: 100 rounds at \$1.95 each, FOB Tulsa .....	\$195.00
<u>INVOICE TOTAL:</u>		<u>\$ 220.00</u>

This invoice faxed to UT/El Paso  
as instructed by Galen Kaip  
at 915-474-0554, 30 Sept 2015

2 Oct: Credit for overcharged freight ..... (\$ 5.63)

INVOICE TOTAL: \$214.37





RESTRICTED ARTICLES, DANGEROUS GOODS  
 CARTRIDGES, SMALL ARMS, BLANK; ORM-D  
 For seismic use only/Not for weapons

TRANSMITTAL - PACKING LIST

From: Betsy Seisgun Inc.  
 7739-D East 38th St.  
 Tulsa, OK 74145 - 3222

To: UNIVERSITY OF TEXAS AT EL PASO  
 DEPT. OF GEOLOGICAL SCIENCES  
 500 WEST UNIVERSITY  
 EL PASO, TX 79902

Attn: Galen Kaip at 915-474-0554

Piece

Contents

- |           |   |
|-----------|---|
| 1. 4G ctn | 100 - Remington R8BL/400BP; 8-gauge industrial percussion blank |
| 11 lbs    | with 400-grain 4Fg black powder load                            |
| 10x10x4"  | 1 - Shell specs, instructions, price list                       |

Shipment: 1 pc/11 lbs/100 shells  
 Via: UPS, Prepaid \$19.37  
 Per: Galen Kaip, phone order, 30 Sept 2015

Shipment Receipt: Page #1 of 1

THIS IS NOT A SHIPPING LABEL PLEASE SAVE FOR YOUR RECORDS

SHIP DATE: Fri 2 Oct 2015

SHIPMENT INFORMATION:

UPS Ground Commercial  
 10.62 lbs actual wt  
 Dims: 10.00x10.00x4.00 in

EXPECTED DELIVERY DATE:  
 TUES 6 OCT 2015 EOD

Carrier Protected = 195.00 USD

SHIP FROM:  
 BETSY SEISGUN INC  
 7739 E 38TH ST

TULSA OK 74145-3234  
 (918) 622-6865

Tracking Number: 1z730x410332402851

Shipment ID: MAEJSKXAPK

Ship Ref 1: - -

Ship Ref 2: - -

SHIP TO:  
 UNIVERSITY OF TEXAS AT EL PASO  
 DEPT OF GEOLOGICAL SCIENCES  
 500 WEST UNIVERSITY  
 EL PASO TX 79902  
 Business  
 (915) 747-6817

DESCRIPTION OF GOODS:  
 small arms ammo markete

(915) 747-6817

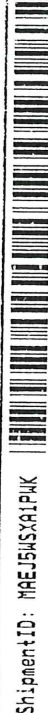
SHIPPED THROUGH:  
 UPS CC TULSA OK  
 TULSA OK 74146  
 (800) 742-5877

SHIPMENT CHARGES:  
 Ground Commercial 15.84  
 Service Options 2.70  
 Fuel Surcharge 0.83

**\$19.37**

Total

COMPLETE ONLINE SHIPMENT TRACKING INFO:  
<http://www.ups.com> address in your web browser to view tracking info.  
 QUESTIONS ABOUT YOUR SHIPMENT? Call the carrier or contact SHIPPED THROUGH facility list.



Shipment ID: MAEJSKXAPK

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 10/02/2015 09:57 AM Pacific Time N

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By: *Paul Martin* 2 Oct 15

**BETSY SEISGUN INC.**  
 P.O. Box 471143 Phone (918) 622-6865  
 Tulsa, OK 74147-1143 USA

Received by: \_\_\_\_\_  
 Date: \_\_\_\_\_