

UNDERWATER SPELEOLOGY

OFFICIAL NEWSLETTER OF THE CAVE DIVING SECTION OF THE NATIONAL SPELEOLOGICAL SOCIETY
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Vol. 2, No. 4- August 75

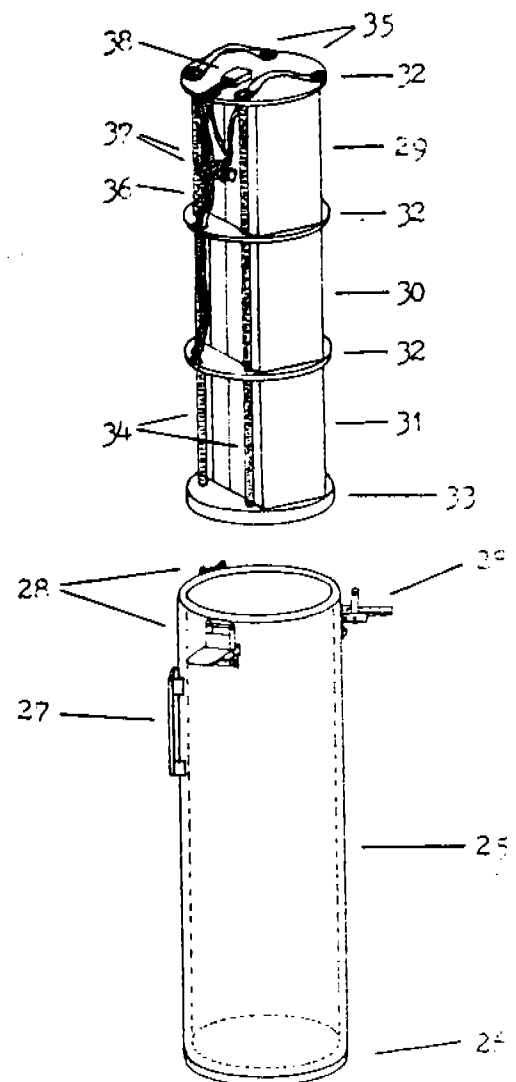
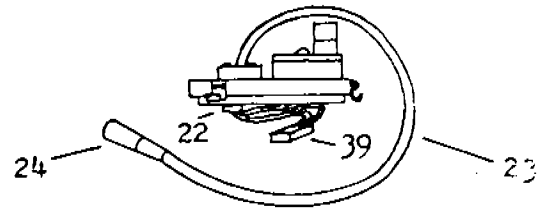
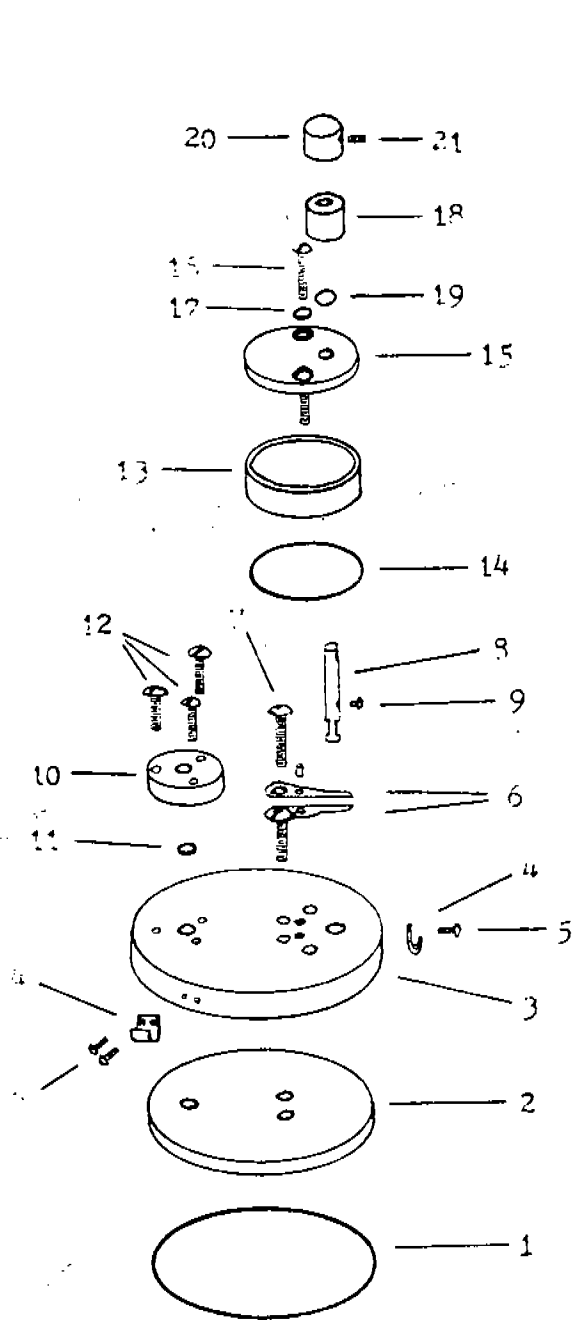


Figure 1. Exploded diagram of battery case top. Part numbers refer to corresponding paragraphs.

Figure 2. Battery base with battery pack removed. See the article on page 31.

UNDERWATER SPELEOLOGY

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correspondence to the Editor:

Stephen D. Maegerlein
Rt. 14, Box 17
Bloomington, Indiana 47401

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Ivan Alan Durall, 1105 Larkin St.,
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ADDRESS CHANGES

Thomas H. Cook, c/o Carl Hallin,
Alton Bay, New Hampshire 03810

Greg McCarty, P.O. Box 1486,
Iowa City, Iowa 52240

Catherine E. Stice, 4014 Howard Ave.,
Tampa, Florida 33607

Charles N. Sturdivant, 297-1 Diamond
Village, Gainesville, Florida 32603

Curtis H. Wheeler, 1500 Sparkman Dr.,
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VENTO SINK, KENTUCKY

"Vento Sink, Roundstone Spring
Complex, and Lone Star Saltpeter Cave:
A Classic Example of the Influence of
Structure on Karst Hydrology in
Kentucky?", an article by Joe Saunders
in The Central Ohio Grotto's newsletter
(COG Squeaks, volume 16, # 11, 1973),
briefly describes a cave dive by Bob
Nadich (NSS 11315), one of our members.
Bob explored a portion of the water
trap on the downstream side of Vento
Sink which is located near the
junction of the Green and Little
Barren Rivers.

The sink is an 80-foot deep karst
window with steep walls which are
climbable on two sides. A cave stream
flows at a rate of 1 cubic foot per
second across the sink for 100 feet
or so before going underground.

CAVE DIVING IN VIRGINIA?

Joe Saunders laments that he keeps finding water traps instead of air filled cave passage. Joe is a spelunker; he is not a cave diver. He found a spring along Walker Creek at the foot of Big Walker Mountain just before it joins Little Walker Creek. The spring contains a 100 feet of air passage some of it 7 feet high and 8 feet wide. The water wells up from a sump along one wall.

Joe dug into another spring below Hamilton Cave which is also located near Walker Creek at the foot of Big Walker Mountain. He entered the cave stream passage but was soon stopped by a 20-foot wide pool which ended the air filled passage at the upstream end.

He also found another sump in a cave in a quarry 1000 feet from Dudding Spring after wading 130 feet upstream from the entrance through a muddy passage that was 10 feet wide and 7 feet high. There should be over 5000 feet of passage between the cave sump and the sink of Meadow Creek, the suspected source.

The foregoing was summarized from The Tech Troglodyte, volume 13, # 1&2, 1974-75, VPI Grotto, Blacksburg, Virginia.

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MICHIGAN CAVE DIVING?

The Spelean Spotlight, volume 3, # 1, January, 1974 contains the following reprinted article. The author's name is not given.

Fayette, Mich. The bearded young archeologist stood on the rocky beach at Burnt Bluff, the waves of Lake Michigan lapping at his heels, and pleaded with the white cliffs in an invented Indian chant... "Na-ko-na-ma," he murmured. "Na-ko-ma."

Then he raised his fist and shook it. "Dumb primitives," he shouted, laughing now at the ghosts who lived in the cliffs thousands of years ago, "Who were you?"

Up in the cliffs in a cave, a 20-year-old Wayne State University student, Alan Hugley, sat in the dirt, a miner's red hard hat protecting his head from falling chunks of cave wall.

He had just discovered a poorly made arrowhead and then some bones, and he was considering them.

"I got it figured out," he said finally. "This Indian spent all day pounding out this lousy arrowhead. Then he took it home and put it on the fireplace and his wife and kids laughed at him, it was so bad, so he killed them."

Meanwhile, below on the beach, the group I was with was preparing to dive under the 200-foot-high cliffs 30 miles south of Fayette in the Upper Peninsula to try to discover still more Indian caves dating from before 3000 B.C.

The Detroit Free Press, August 29, 1965

REVIEW: CAVE DIVING GROUP NEWSLETTER

reviewed by Sheck Exley (NSS 13146)

CAVE DIVING GROUP NEWSLETTER, printed quarterly by the Cave Diving Group, Dr. Oliver C. Lloyd, editor, Withey House, Withey Close West, Bristol, Great Britain Bs9 3SX. Approx. 27 pages per issue. \$10.00 per year (4 issues).

The Cave Diving Group Newsletter remains the most impressive periodical on cave diving that this writer has seen to date. The basic content of the magazine is detailed reports of new diving explorations in the caves of the British Isles, complete with some very fine maps. The activity of the Group and their excellent safety record are somewhat astounding given the relatively poor diving conditions (water temperature, visibility, restrictions, etc.) that they routinely encounter. In addition to reports of dives in Great Britain, it is not uncommon to find accounts of dives in various parts of Europe, Turkey, etc. as well. A few letters to the editor, announcements of coming events and minutes of meetings round out the format of the newsletter.

Readers interested in keeping up-to-date with the latest advances in British cave diving equipment and procedures will find this publication somewhat disappointing, for there is little information on this subject in the newsletter itself. However, there are several additional publications of the Group that fulfill this function. The explorer and scientist will find the newsletter of considerable interest, however. This writer personally envies the organized manner in which British cave diving exploration is carried out and reported in the Cave Diving Group Newsletter. It is obvious that the newsletter exerts a profound influence on and somewhat of an impetus for these explorations. The magazine lacks the photographs that one might find in Skin Diver Magazine, etc.

Not only is the Cave Diving Group by far the oldest cave diving organization in the world, but also its members have pioneered in virtually every phase of cave diving. For example, members of the Group were the first to use SCUBA in caves (with air or oxygen) and even the first woman cave diver was a member of the Group. While many Americans would disagree with some of the procedures of the Group, such as solo cave diving, the fact remains that the British approach works and their safety record is amazing.

In summary, the price of \$10.00 per year is a real bargain for any caver or diver interested in the exploration, survey, and scientific investigation of underwater caves.

* * * * *

SOS... HELP SAVE LOST RIVER!!!

by Sheck Exley (NSS 13146)

For quite some time now cavers and cave divers have viewed with alarm the proposed project that would have catastrophic effects on the Lost River system of caves, sinks and resurgences. The Lost River area is one of the truly outstanding karst features of its kind in the entire country. The cave network, located in south central Indiana, contains many delicate organisms that could be irrevocably damaged by any drastic changes to their environment, such as partial inundation of the area by the proposed project.

Amblyopsis spelaea, the blind northern cave fish, inhabits the cave, as do numerous species of cave crayfish and other troglobitic crustaceans. Bats also inhabit dry areas of some of the caves.

The Orangeville Rise, a registered National Natural Landmark, is a resurgence of the system. Purchase of the rise by a responsible conservation group would do much to protect the entire system. Such a group is the Nature Conservancy, which has protected other noteworthy caves and other natural features from similar destruction in the past such as through the purchase of Shelta Cave in Alabama, Ezell's Cave in Texas, and hopefully Devil's Icebox in Missouri in the near future. The Nature Conservancy is attempting to raise \$5,000.00 to purchase the Orangeville Rise. Membership donations of \$10.00 or more should be sent to the Nature Conservancy, 1800 North Kent Street, Arlington, VA 22209. Incidentally, the Lost River Conservation Task Force endorses the Nature Conservancy's efforts.

For an account of cave diving operations in the area, see page 30, volume 1, # 6 of Underwater Speleology.

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A LIQUID CHROMATOGRAPHIC TECHNIQUE FOR IMPROVING FLUORESCEIN DYE TRACING TESTS

by Stephen D. Maegerlein (NSS 8340)

Fluorescein dye (disodium fluorescein) tracing is a method commonly used for locating the resurgence of underground water systems. A concentrated aqueous solution of the dye is mixed with water flowing into a swallowhole or an inaccessible cave passage. Activated charcoal packets (called bugs) are placed in all the possible springs or streams where the dyed water might resurge from underground. The packets are usually made of plastic screen wire, packet sides are sown or stapled together, and filled with 2 to 3 grams of activated charcoal (8 to 12 mesh). Stiff wire (clothes hanger or picture wire) is used to secure the packets to the bottom of the streams. The activated charcoal sorbs the dye which has been greatly diluted through the porous bug and accumulates the dye which has been greatly diluted during its underground journey. The bugs are later collected for analysis to determine which underground resurgence carried the dye. A sample of charcoal from each bug is placed in an alcohol solution containing 5% potassium hydroxide (KOH). The caustic alcohol solution extracts the bright green dye from the charcoal to indicate a positive test. Even a few parts per million of the dye can be detected by observing the solution under a long wavelength (375 nanometer) ultraviolet (UV) lamp. The dye solution glows green under the lamp.

Recently, several dye tracing tests made in the central Indiana karst area have been negative or of uncertain results. The alcohol extract of the charcoal bugs often has a greenish-white fluorescence which tends to obscure a weak fluorescein test under the UV lamp. The interfering fluorescence found in the bugs is probably caused by laundry detergent brighteners. The shallow cave systems of Indiana are apparently easily polluted by septic tank effluent. Indiana has a state law banning phosphate type detergents, thus using fluorescent fabric brighteners is a common method of covering up the "gray look" of clothes which have been washed in non-phosphate detergents.

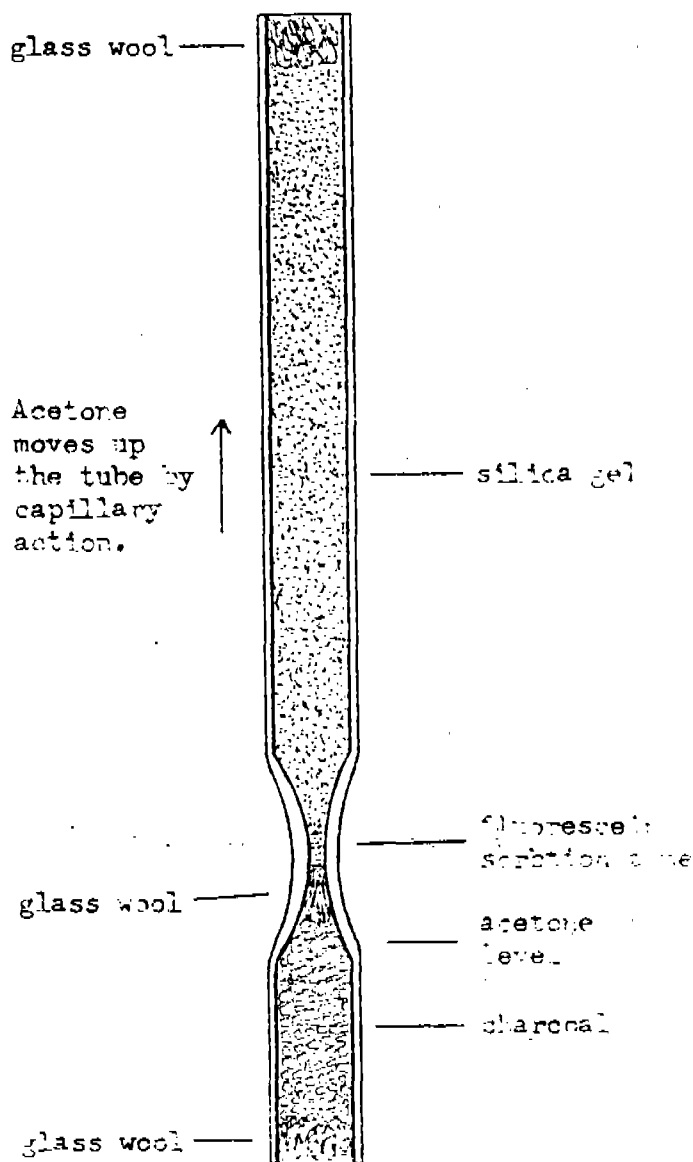
Liquid chromatography can be used to concentrate the fluorescein dye and separate the dye from fabric brighteners when the alcohol-KOH test is not satisfactory. The chromatographic technique requires a piece of Pyrex tubing one centimeter (cm) inside diameter and 15 cm long as shown in the drawing. The test is more sensitive if the tubing is constricted to 0.2 cm inside diameter 4 cm from one end. A small wad of glass wool is placed in the constricted portion of the tube.

Charcoal from a bug is air dried to remove most of the moisture. The shorter section of the tube is filled with dried charcoal (1 gram) to within 1 cm from the tube end. The end is plugged with a wad of glass wool. The tube is inverted and the end of the tube containing the charcoal is placed in a reservoir such that the end of the tube is immersed in 2 to 3 cm of acetone. The acetone migrates up through the glass wool and charcoal filling the air space in the glass wool and charcoal. The upper section of the tube is then filled with silica gel (2.5 gram) to within 1 cm of the tube end and topped with a glass wool plug. Fluorescein dye and/or fabric brighteners in the charcoal are extracted by the acetone and carried up into the silica gel beyond the tube constriction.

The fluorescein dye is sorbed by the silica gel at the constriction and remains there as a narrow concentrated band. The fabric brighteners are transported up the silica gel column by the acetone. The acetone will migrate up the silica gel column by capillary action. The glass tube is removed from the reservoir when it appears that the acetone is near the top of the silica gel. The tube is inverted for a few minutes to allow acetone to drain from the charcoal into the silica gel.

The tube is examined under a long wavelength UV lamp to determine if a green fluorescent fluorescein band is present at the tube constriction. Fluorescence in the upper portion of the silica gel tube may be caused by water pollutants.

The Pyrex tube may be cleaned after the test and the contents should be discarded. The charcoal and silica gel can not be easily cleaned and should not be reused.



Liquid chromatograph column used to isolate fluorescein.

The materials used for the chromatography test are stocked by most laboratory supplies distributors. The silica gel is harder to find than the other materials. VWR Scientific, P.O. Box 855, Columbus, Ohio 43215 supplies this material. It is listed as Silica Gel, J. T. Baker Analyzed Reagent (60 - 200 mesh) -- suitable for chromatographic use, catalog # JT 3405-1. The chromatographic tubes are prepared by heating Pyrex glass tubing in a torch flame to form the constricted zone.

The two dye detection methods have been compared quantitatively using activated charcoal samples which have sorbed fluorescein from standard dye solutions. The chromatographic method is more sensitive than the alcohol-KOH method by a factor of 2. The methods were also compared using activated charcoal which had been exposed to water in a polluted stream. The alcohol-KOH test method gave an intense white fluorescence which mask the fluorescein test. The fluorescent materials from the charcoal did not interfere with the chromatography test for fluorescein.

The chromatography method is not a substitute for the alcohol-KOH method but should be used when alcohol-KOH tests are negative or inconclusive.

* * * * *

BUILDING A BATTERY CASE FOR A CAVE DIVING LIGHT

by Stephen D. Maegerlein (NSS 8340)

The battery case described below was designed as a power supply for the helmet light featured in the February, 1975 issue of this newsletter. The case is worn on a weight belt at the diver's side. The switch on the case top is optional and not needed since there is an off-on switch on the helmet light. The switch was placed on the case because I prefer to turn off the batteries when taking off diving equipment to explore dry cave passage beyond water traps. The switch chamber is isolated from the battery compartment to minimize the possibility of a spark causing a hydrogen explosion.

The following numbered paragraphs refer to numbered parts in figures 1 and 2 on page 25.

- 1) The lid seal, rubber o-ring, $1/8$ " cross section, is slightly smaller than the $4\frac{1}{2}$ " diameter lower lid plate (2) so that the o-ring seals against the plate.
- 2) The lower lid plate is $3/8$ " thick by $4\frac{1}{2}$ " diameter Plexiglas G (polymethyl methacrylate plastic). The plate was cut using a router with circle cutter attachment as were all other circles of plastic used in this project. A cross section of the lid is shown in figure 3.
- 3) The upper lid plate is $\frac{1}{2}$ " thick by 5" diameter Plexiglas G. Holes were drilled in the top plate for the cable seal and switch parts. The lower lid plate (2) was clamped to the upper lid plate and holes were drilled through both plates to accept the $\frac{1}{4}$ " diameter electrical cable and the electrical feed through bolts (7) for the switch.

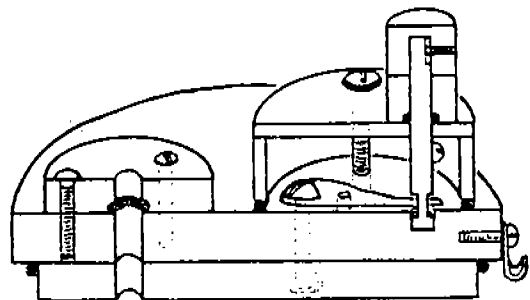


Figure 3. Cross section of case top.

The upper and lower plates were glued together using methylene chloride for cement.

4) Latch hooks for the lid are from a camera latch kit obtained from Ikelite Underwater Systems (IUS). The three hooks are spaced equidistant around the edge of the upper lid plate.

5) The three hooks are secured with screws, 3/8" long, 1/8" diameter, made of nickel plated steel. The screw holes are centered on the plate (3) edge.

6) Switch contacts were cut from 0.032" thick brass shim stock obtained at a local hardware store. The dimensions of the contacts are shown in figure 4.

7) The switch electrical feed through bolts are 3/32" diameter and 1 1/8" long, brass, roundhead screws. The bolts were soldered to the switch contacts (6) so that the contacts would be more rigid. RTV silicon rubber cement was used around the bolts to seal the switch compartment so that hydrogen gas could not leak into the switch compartment from the battery case.

8) The switch shaft was made from a piece of 1/4" diameter by 1 7/8" long brass rod. Slots were cut near one end of the shaft to form switch contacts as shown in figure 5. A hole was drilled and threaded in the shaft for a retainer screw (9). A flat area was cut at the other end of the shaft to serve as an anchor point for the knob set screw (19).

9) The retainer screw acts as a stop to keep the shaft from being pulled out of the switch housing. The screw is 1/8" diameter and 1/8" long.

10) The cable seal plate is 1 1/2" diameter by 3/8" thick Plexiglas G plastic. The plate has a hole through the center to snugly hold the 1/4" electrical cable (23). A shoulder was cut around the edge of the plate for an o-ring (11). Three holes, 3/16" diameter, were drilled through the plate with centers 1/4" from the plate edge and equidistant around the plate.

11) An o-ring was placed in the shoulder around the hole for the cable (23). The shoulder is smaller than the o-ring cross section so that the seal plate (10) compresses the o-ring and causes it to seal against the cable.

12) The three cable seal plate bolts are roundhead, 3/8" diameter by 3/4" long. They fit through the cable seal plate (10) and thread into the upper lid plate (3).

13) The switch chamber body is a 3/16" thick Plexiglas G or polyvinyl chloride (PVC) ring, 1/2" tall and 2 1/4" outside diameter. The bottom of the ring had a rounded groove cut in the edge to seat an o-ring (14). The groove was cut using a lath.

14) The o-ring which seals the base of the switch chamber body is 1/8" cross section and 2 1/4" outside diameter. An o-ring with the proper diameter was made by cutting a section out of a larger o-ring and gluing it together with Onida Instant-Weld cement.

15) The switch chamber top is a 3/16" thick by 2 1/4" diameter Plexiglas G plate. A 1/4" hole was drilled in the plate 9/16" from the edge of the plate for the switch shaft. Two holes 3/16" diameter were cut for the bolts that hold the switch chamber to the upper lid plate (3). Pilot holes were drilled through the chamber top and into the lid plate (3) placed under it so that the parts could be properly aligned. A shoulder, 1/16" deep, was cut around

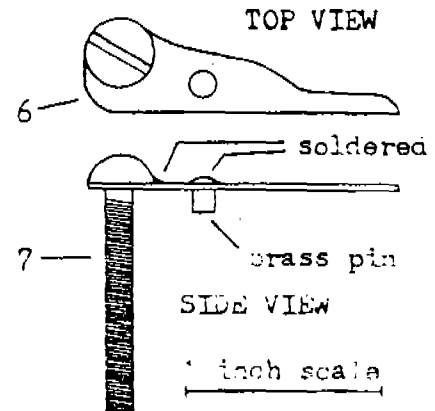


Figure 4. Switch contacts shown in two views.

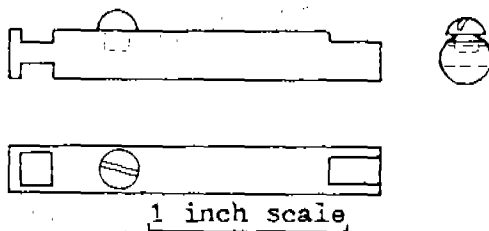


Figure 5. Electrical switch shaft shown in three views.

each bolt hole for an o-ring (17). The shoulder was made by drilling a 1/16" deep hole 5/16" in diameter before drilling the 3/16" diameter bolt hole through the same center.

16) The 2 bolts for the switch chamber top are 3/32" diameter by 1" long.

17) The o-rings used to seal around the bolts are 1/16" cross section and 5/16" outside diameter.

18) The switch shaft collar is a 1/2" long piece of 3/4" diameter Plexiglas G rod. A hole, 3/8" diameter and slightly less than 1/16" deep was drilled in the center of one end of the collar. The edge of the hole is the shoulder for the o-ring seal (19). If the shoulder is too deep, the o-ring will not fit tight enough. The plastic collar will break if the shoulder is too shallow because a tight o-ring will cause stress cracking. A 1/4" diameter hole was drilled all the way through the center of the collar for the switch shaft (8). The collar was glued to the chamber top using the shaft for alignment. Plexiglas cement was used sparingly to avoid squeezing glue into the o-ring slot.

19) The o-ring for the switch shaft is 1/16" in cross section and 3/8" outside diameter. The o-ring was inserted in the collar-chamber top assembly after the glue had dried for 24 hours.

20) The switch knob is a 3/4" outside diameter electrical equipment knob obtained at a local electronics store.

21) The knob set screw is 1/16" diameter and 1/4" long.

22) The cable clamp is a 1/4" diameter hose clamp. The clamp keeps the electrical cable (23) from pulling out of the battery case lid.

23) The 2-foot long electrical cable is a 1/4" diameter, 2 wire, rubber insulated electrical cord.

24) The quick disconnect cable plug is a male, Amphenol, 4-pin, microphone connector obtained at a local electronics store. Each cable wire was soldered to two pins inside the connector to improve the electrical contact between connectors. The solder joints and cord inside the connector were coated with silicone rubber cement before the connector was assembled.

25) The case body is a Plexiglas G or PVC tube, 1/4" thick, 5" outside diameter and 14 1/8" long. The ends of the tube were cut off square with a hand saw and miter box. The tube end which seals against the lid o-ring was ground smooth using extra fine sandpaper on a flat surface. The dimensions of the case depend on the size of the nicad batteries used in the unit.

26) The bottom of the battery case is a 1/2" thick, 5" diameter piece of Plexiglas G which has a 1/4" wide and deep shoulder cut around the edge. The bottom plate was glued to the bottom of the case with Plexiglas cement.

27) The belt bracket posts were made from two pieces of Plexiglas G, 1/2" thick, 2" long and 5/16" wide. A curved cut was made into each post with a 2 1/2" radius as shown in figure 6. The bracket plate is Plexiglas G, 2" by 3" and 3/16" thick. The top of the bracket was placed 2 1/2" below the top of the case body (25).

28) The latches are camera case latches supplied by IUS. The screw holes for the latches were drilled all the way through the case and threaded. The screw holes were sealed on the inside of the case with Plexiglass cement after the latches were mounted.

29) All the batteries in the unit are Sonitone nicad batteries. The dimensions of the batteries are 2 1/8" wide, 15/16" thick and 4" high. Their electrical storage capacities are between 4.5 and 5 amp hour. The top stack contains 4 batteries connected in series.

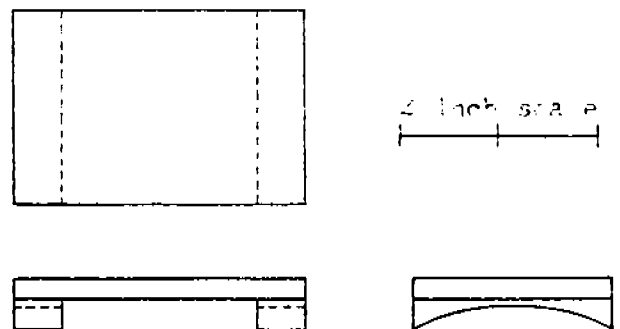


Figure 6. Weight belt bracket shown in three views.

- 30) The middle stack of batteries contains five cells. Three of the batteries were connected in series with the top 4 batteries. The other two batteries were connected in series to the bottom stack.
- 31) There are five batteries in the bottom stack. They were also connected in series.
- 32) The battery support plates are 3/16" thick, 4 7/16" diameter Flexiglas G. Four holes, 5/16" diameter, were drilled in the plates for the support rods. A slot was cut into the edge of each plate 5/16" wide to allow room for the battery wires.
- 33) The battery base plate is 3/8" thick and 4 7/16" diameter. Four holes were drilled and threaded for the support rods.
- 34) The four battery support rods are 1/4" diameter threaded rod, 13 1/4" long, and made of zinc plated steel. The rods were sprayed with acrylic paint to protect them from electrolyte that may leak from the batteries. A nickel plated steel nut is used on top of each rod to hold the assembly together.
- 35) The two handles used to lift the battery assembly from the case were made from 3 1/4" long pieces of 1/4" diameter, tinned copper, tubular, braid cable. The ends of the flattened cable were filled with solder. Holes were then drilled in the soldered ends so they would fit over the 1/4" support rods. The handles were secured under the retainer nuts. In case braided cable is not available, large holes can be cut in the top support plate (32) for inserting the fingers to lift out the battery assembly.
- 36) The two sets of seven batteries in series were connected in parallel to give an 8.4 volt battery pack with a capacity of 9 to 10 amp hour. The batteries were connected together with insulated # 16 solid copper wire.
- 37) The wires are held together with two split bolts. This type of electrical connector has a 1/8" slot in the bolt and a nut which tightens down on wires placed in the slot. The bolts are available at electrical supply stores. The bolts also serve as the terminals for the battery charger clamps.
- 38 & 39) Male and female, Waldom-Molex, two wire plugs are used to connect the battery assembly wires to the case lid cable. The plug should be polarized if a dimmer circuit is used for the helmet light.

A helmet light dimmer will be described in a future newsletter.

A list of sources of materials is given in the February issue of this newsletter, page 7.

The battery case weighs 14 pounds out of the water and has a few pounds of negative bouyancy in the water. The case cost about \$90 in materials. The helmet light weighs 3 pounds out of the water and has slightly negative bouyancy in the water.

* * * * *

HAND SIGNAL STANDARDIZATION

by Lewis Holtzendorff (NSS 14831)

The Hand Signal Standardization Committee was established at the August NACD Board Meeting. The purpose of this committee is intended to survey cave divers as to what hand signals they use and to solicit any comments they may have regarding standardization. Using this as a basis, the committee should subsequently draw up a recommended list for presentation to the Board of Directors at the December meeting.

Standardization could alleviate misunderstanding between cave divers who now use disimilar signals to convey the same message. For example, I have seen five different hand signals used to convey the "terminate dive" signal.

The complex nature of cave diving requires a more extensive "vocabulary" to improve safety and efficiency underwater.

In choosing what hand signal would best convey a particular message, the following qualities should be considered:

1. Distinctive -- so as not to be confused with another hand signal,
2. Descriptive -- easy to remember and comprehend,
3. One-handed Performance -- the other hand is usually occupied with light, stabilization, line contact, reel, etc.,
4. Popular -- will gain universal acceptance among cave divers.

A list of messages follows:

1. Please strike out any which you feel would be superfluous,
2. Add any messages which you feel would be helpful,
3. To the right of all messages please describe the the hand signal which you would recommend to convey that message.

Do the best you can to describe and/or illustrate each hand signal on your list. We would also appreciate any comments of a specific or general nature regarding standardization of hand signals.

Please send your recommendations to:

N.A.C.D. Hand Signal Standardization Committee
c/o Lewis Holtzendorff
1614 N. Patterson St.
Valdosta, Georgia 31601

MESSAGE

HAND SIGNAL

1. "O.K." or Affirmative
2. Negative
3. Terminate Dive
4. "I Need Air"
5. "I'm Out Of Air"
6. "Don't Feel Good"
Vertigo
Narcosis
7. "I Have A Problem Here"
8. Repeat Hand Signal
9. "That Way Is Out Of Cave"
10. Query
"What"
"Where"
11. "A Lot"
12. "A Little"
13. "Let's Go That Way"
14. "Hold"
15. Slow Down
16. Speed Up
17. Come Here
18. "Let's Swap Positions"
19. Attention
20. Line

* * * * *

NSS Case Diving Section
STEPHEN D. MAERLEIN
R. R. 14, BOX 17
BLOOMINGTON, IND. 47401