

ARCHERY WORLD

November 1975 75¢



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A Broadhead
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How To Get
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COVER PHOTO: The business end of a hunting arrow is highly critical. A razor sharp broadhead can be more effective, and more humane, than a feather edge. Full details are in the story beginning on page 28. Photo by Bill McRae.

The bow is a primitive instrument . . . and a historical instrument.

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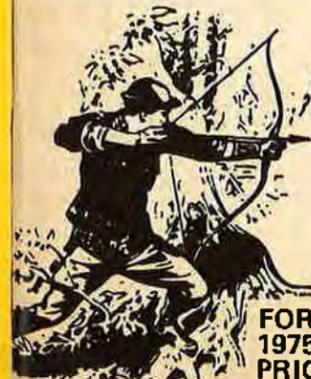
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Archery World welcomes your comments on any topic relative to archery. Address your letters to Write On, Archery World, 534 N. Broadway, Milwaukee, Wi. 53202.

BOW TEST COMPLAINTS

Your compound bow test reports would be more meaningful if test results were included for maximum peak weight. Hunters seeking compounds obviously want the "big but controllable punch," and this group must be large and growing, according to your recent articles.

Secondly, all bow limbs worth mention, including compound limbs, should achieve their best efficiency at maximum rated capacity. For this reason, a compound should be selected with a maximum peak weight as close to what the shooter plans to shoot as possible. Do you agree? What do the compound manufacturers say?

Addition of a bow string-to-cable-clearance heading in the technical data section of your compound bow reports would be helpful. My Herter's Magnum has a measured clearance slightly more than 5/8-inch, the greatest of any compound I've examined. This allows for a large three-feather hunting fletch without any contact between the feathers and cable whatsoever.

Your statements on Herter's cable clearance were not all that clear, and this feature should be a very important consideration, as expressed by my fellow club members who are faced with this problem.

Cecil D. Johnson
Rockford, Ill.

• We concur; generally compound bow efficiency should be highest at maximum rated peak draw-force.

Perhaps you missed the compound bow test report in the June/July 1975 issue of Archery World. We reported on a test of the Allen 7306 Black Hunter and covered this point in some detail. However, note we've qualified the statement with "generally." As draw weight is increased, friction in the compounding system also increases, substantially reducing the expected increase in efficiency. Under specific conditions, the increased system friction could offset the gain from limb efficiency [as the limb materials are worked closer to their design limits] and the net result would be little or no gain in overall bow efficiency.

In testing the Herter's Compound Power Magnum, we were faced with an unusually large range of peak draw weight adjustments [40 to 65 pounds] in a single bow. We decided to cover the 45 to 55 pound spread in five-pound increments since this is the peak draw force range into which most of our bow tests have fallen. When we select a bow for test we look for something in that general draw-force range in which we feel most of our readers would be shooting. Perhaps on the compound tests we should hit the top, middle and bottom of the

peak draw weight range of the test bow when the bow is adjustable.

With regard to cable clearance, on many compound bows, cable clearance can be varied by the manner in which the bow is rigged. The Herter's compound requires part replacement to increase the cable clearance. Five-eighths-inch clearance is quite good — in fact, better than most. On compounds with mid-limb idlers, the cable clearance can usually be improved by angularly offsetting the idler suspension brackets or hangers within reasonable limits, or by increasing the diameter of the idler pulleys [or both]. The latter approach may require new cables if sufficient adjustment is not present in the cable adjustment system.

Ever sit down and try to diagram a consistent and foolproof method to measure cable clearance that will cover all types of compound bows? Remember, arrow pressure point lateral location is one element in the geometry, and pressure point position can vary with draw weight, draw length, shooting style, arrow spine, arrow mass distribution and a few other elements. Perhaps we should agree to use the vertical centerline of the bow at the pressure point location and the string at the nocking point location and measure the cable offset from a theoretical straight line joining these two points. Or, as a more direct method, we could standardize on a 5/16" diameter arrow, nock it on the string, align the inner surface tangent to the vertical centerline of the bow, using a spacer block of appropriate thickness, and then measure the shortest distance from the side of the arrow to the nearest cable. We think you have cited a characteristic worth thinking about — we have also heard a number of complaints about inadequate cable clearance.

(continued on page 10)

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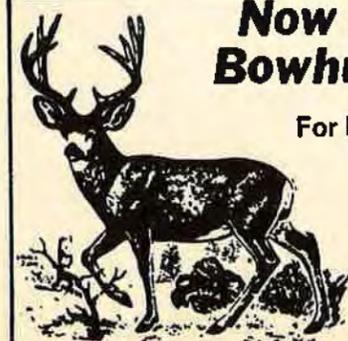
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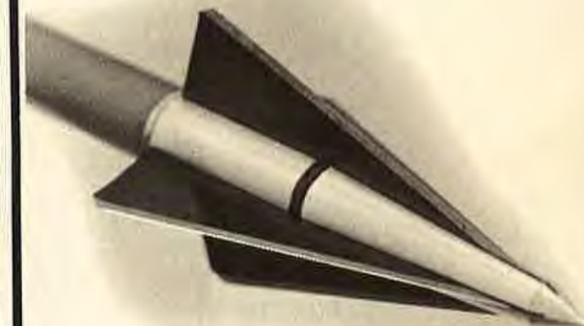


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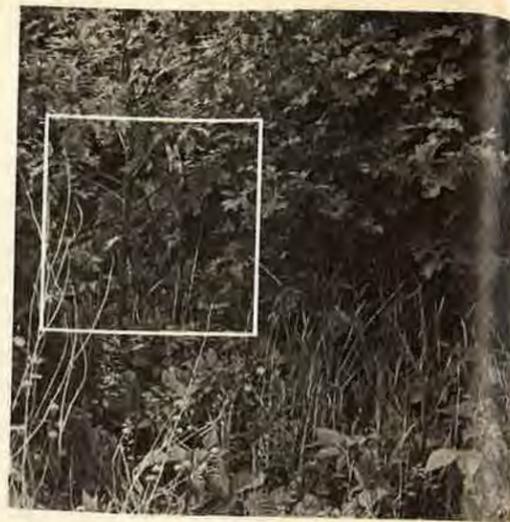
(Continued from page 9)

HIDDEN HUNTER?

In the camouflage story in the August/September issue, you mentioned that a camouflaged hunter was hidden in the left side of the photos 1-4 on pages 40-41. Where?

Grant Terroon
Dallas, Texas

• The sapling splits the outline of his Jones-style cap. To the left of the sapling is his shoulder outline; to the right of the sapling is the upper limb of the bow.



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• We suggest you contact two companies for information about straight bows of the type Howard Hill and Don Brown are known for: Howard Hill Archery, Rt. 1, Box 1397, Hamilton, Mont. 59840, and Herter's, Archery Division, Waseca, Minn. 56093. The first company makes several models of longbow. Herter's has a longbow called the "Itasca."

SEEKS STRAIGHT BOW

According to Don Brown's comments in your article about his incredible exploits ("Don Brown Wants To Shoot The Heaviest Hand-Held Bow Ever," March issue), he uses very heavy straight bows. I draw a 75-pound, 60-inch Damon Howatt bow and would like to draw a heavier, 100-pound bow but cannot find one in France. Could you supply me with the address of a manufacturer of straight bows such as those used by Don Brown or Howard Hill?

Jean-Marie Coche
Chateaufneuf D'Isere
France

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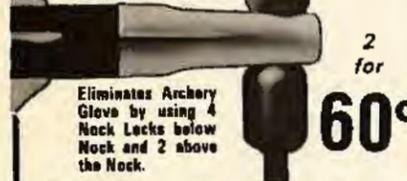
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tackle topics

To have your technical questions answered, send them to either Al Henderson, Henderson Archery Center, 1534 West Van Buren, Phoenix, Az. 85007 or Len Cardinale, Butts & Bows Archery, 468 Washington Ave., Belleville, N.J. 07109.

TECHNICAL MATERIALS

What technical material has been published regarding the geometry, materials, construction and performance of bows in the past few years? The only reference I have is "Archery: The Technical Side" by Klopsteg, Hickman and Nagler, published in 1948. Brendan Gaffney Wellington, New Zealand

• Hang onto that copy of "Archery: The Technical Side." The basic design principles and theory set forth by the authors are the foundation for most everything that has been done in equipment design. New materials and their specific design characteristics and requirements extend the basic theory and improve performance, but the principles established still hold.

Unfortunately, the art and science of

bow design and construction has not had broad publication in recent years. Here are two items you might find helpful: Catalogue No. 3-01 Instructional Materials, Bingham Archery, P.O. Box 3013, Ogden, Utah 84403, for \$3.50; How To Make Bows, by Jennings and Kittredge, Sportsman Publications, P.O. Box 386, South Pasadena, California.

You might also watch future issues of Archery World. We will have bow reports covering performance, with some theory and technical commentary. On page 40 of this issue is a detailed report on how these bow tests are accomplished, including formulae for determining performance and efficiency.

JERKING HABIT A PROBLEM

I have been interested in archery on a serious basis for some five years. I shoot a 70-inch, Magna Flight Maximum tar-

get bow, 31 pounds at 28 inches, with a Root Stabilizer, Check-It Sight and Berger Button. My arrows are Easton 24 SRT-X 1713 with Spin-Wing fletching.

Over a long period of time I have developed a habit of jerking my bow to the right just as I release. This jerking has caused me to hit consistently to the left on the target. I've tried everything I can think of to break this habit, without success. Needless to say, this problem has become very discouraging. Any advice you can give will be appreciated.

Ken Byker
Hudsonville, Mich.

• Assuming you shoot right handed, the natural reaction of the bow upon release is to the left. Since the arrow clears the bow in milliseconds, it may be clear before you jerk the bow right. Thus, the solution may be as simple as resetting the sight to compensate for the left shooting. Don't be reluctant to let the bow do what it wants; hold your bowarm solid, but let it move naturally to the left that slight little bit. You may be trying to stop this action by jerking the bow to the right. So instead of trying to undo some-

thing, concentrate on building consistent form and let the arm go left naturally, but not to the point of throwing your arm.

STRING TWISTING?

What is the limit a person can twist his string? I have a 60-inch, 45-pound Super Kodiak, use a Hoyt pro rest and draw 29 3/4-inches. While experimenting to get the most cast from my bow with my heavy 312 Magnums, I went from a 57-inch string to a 59-inch string and twisted it down. This took my brace height from 8 1/4-inches to 7 1/2-inches. Could the twisting warp my bow or otherwise damage it?

Jerry Butler
Eaton, Ind.

• You don't want to twist a string to the point that it kinks and acts like a coiled spring, but up to that point you should have no problem. Some people maintain a safety rule of thumb of never twisting a string more than 12 turns. The only way a highly twisted string could damage your bow would be if the string broke.

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Dr. Julian Smith, Archery Instructional Pioneer

DR. Julian W. Smith, the late Director of the Outdoor Education Project of the American Alliance for Health, Physical Education and Recreation, gave leadership to the concept that outdoor education was a method of teaching that encompassed all areas of the curriculum.

Julian often said the good teacher was certainly an outdoor educator for "Outdoor education is a means of curriculum enrichment through experiences in and for the outdoors. It is not a separate discipline . . . it is simply a learning climate which offers opportunities for direct experiences in identifying and resolving real-life problems, for acquiring skills with which to enjoy a lifetime of creative living, for attaining concepts and insights about human and natural resources, and for getting us back in touch with those aspects of living where our roots were once firmly established."

Since 1955 — the inception of the Outdoor Education Project — Julian gave leadership to the "for" of outdoor education. A major portion of his time was devoted to conducting workshops for teachers and recreation leaders in schools, colleges and recreation agencies around the country. His travels brought him in contact with thousands of leaders who in turn developed or improved their programs in outdoor skills. Through them the impact on the quality of learning reached literally hundreds of thousands of children and students of all ages each year.

A modest, humble, sincere man, he

developed a cadre of leadership to conduct this workshop nationwide. Julian's sense of humility is seen clearly when he wrote in reference to himself: ". . . any success in leadership must be given to a simple and humble home where work and the good use of leisure time were basic . . . positions in education where initiative and creativity could be exercised . . . and the opportunity to be associated with outstanding educational leaders of our times. . . ." Yet his impact upon people was so great, his acknowledged leadership so significant, that more than 15 national associations and organizations honored him with their highest awards for professional service.

The first Outdoor Education Project Archery Workshop was held in 1960.

Out of these workshops was developed a group method of teaching archery, an instructional booklet, film loops and AAC Basic Instructor and Advanced Instructor certification.

The method of instruction was based on "immediate participation — immediate success." Julian was very pleased when the participants were shooting within 30 minutes and how the instruction emphasized the variety of ways archery could be enjoyed. Most people were successful. Hitting the target for a beginner, whether a child or adult, is important.

The variety of activities included within the instructors' workshop included target and field archery, clout shooting, archery golf, tic-tac-toe and

many other games. Variety is of importance to good instruction, while shooting at the same old target may turn many beginners to other things.

The method of instruction provided ways to conduct archery instruction with large groups (most physical educators and recreation leaders don't have the luxury of teaching to small groups). Schools and recreation agencies were shown: that light draw weight bows were best for beginning instruction;



equipment could be purchased that was inexpensive but very durable and within the school's or the recreation agency's budget; that many areas within the school building could be used for archery, since short distances are very adequate for learning the skill; and the use of a nylon net or a substitute type of backdrop.

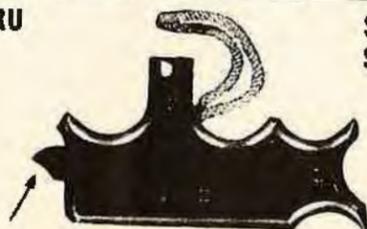
He was firmly convinced of, and tried to provide others with, the concept that those who were participants of outdoor activities were the future conservationists of our country. For he often said, "Who better will protect, defend and preserve our natural settings than the sportsmen who use them."

Dr. Smith was 73 when he died June 23 in Lansing, Michigan.

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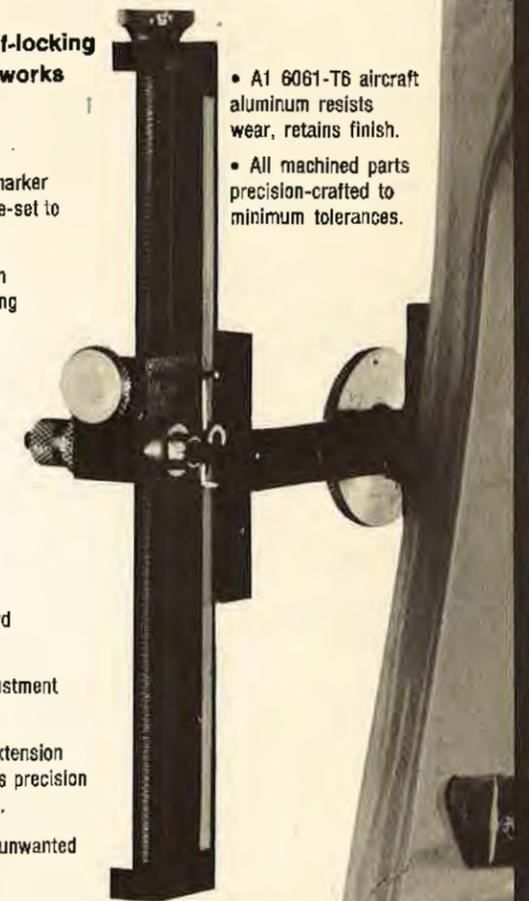
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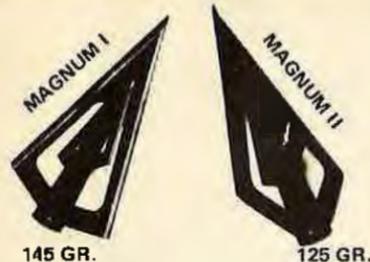
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Well, it isn't that simple and everyone who hunts knows that. For one thing, most deer you hit don't drop in their tracks. And if your deer doesn't drop immediately, you're going to have to go find it.

Knowing how to follow a blood trail is an important skill every bowhunter should acquire. The only way to become proficient as a blood trailer is through experience. Every animal you arrow will add to your skill, because every animal reacts differently when hit.

Dozens of thoughts flash through a beginner's mind the instant he arrows his first deer. Confusing thoughts. Maybe a moment of panic. But this is the critical time when you need to maintain discipline and keep some basic things in mind:

- 1) Watch the deer as long as possible before you move from your hiding spot, and before you attempt to trail it;
- 2) Mark the spot from where you shot before you move;
- 3) Mark the spot where the deer was standing or moving when you shot;
- 4) Find the arrow, if it passed through the animal;
- 5) Determine what kind of hit you

had. A good hit will show bright red or foamy blood. A stomach hit will show traces of green and dull red mixed blood, slimy and smelly;

6) Take note of the weather conditions and time of day. Pending rain and darkness can mean problems;

7) If possible, wait 30 minutes to one hour before you begin trailing;

8) Get help if possible. Three or four sets of eyes are better than one set . . . but too many helpers may cause you to lose the trail, too.

You should also keep in mind the way the deer reacted when the arrow struck. Many times, this is a very good indication of the place the arrow struck.

1) Heart shot — deer usually leaps wildly;

2) Lung shot — deer usually bolts and runs straight and hard;

3) Kidney shot — deer may take two or three jumps, and then walk away;

4) Belly shot — deer may just walk away after a startled jump, or it may run with legs widespread and back hunched;

5) Spine hit — deer should drop immediately;

6) Back hit — deer may act as though it were not hit at all, bleed for 200 yards or more and keep moving. After a few days of rest, it'll heal and the wound will cause no problems;

7) Loin shot — similar to lung shot reaction;

8) Neck shot — not a serious wound unless jugular vein is cut, and the deer usually runs away leaping;

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9) Brisket shot — usually not serious, and reaction similar to back hit;

10) Liver shot — similar to kidney hit. The deer may travel a quarter-mile before dropping.

Once you begin following a blood trail, keep moving as fast as the trail will permit. Do not, however, walk on the blood trail. Follow it to one side. When the trail becomes hard to follow or see, kneel down to look more closely for any sign. Turned up leaves, blood specks on the grass, a broken twig may be the signs you'll need to find.

Mark the trail as you move with colored rags, or small piles of stones or broken sticks. And think like a deer. A wounded deer moving downhill will be easier to find than one moving uphill.

Other signs and practices will help you learn the art of blood trailing more rapidly:

1) Keep in mind how your arrow entered the deer — flat, upward angle, downward angle, high, low, right side, left side? The hit may give you better ideas about where to look for blood;

2) Mark the spot where you found the first blood;

3) Blood may be on the ground, on grass, rocks, leaves, trees. Don't overlook anything;

4) Blood sprayed over a wide area may mean a lung shot, and the deer is bleeding blood through his nostrils;

5) Blood in big spots close together may mean an artery or heart shot;

6) Blood high on grass or brush, but not on the ground, may mean a leg hit;

7) Watch closely for hoof prints, whether you can find blood or not;

8) If you're convinced you have opened a good bleeding wound, but maybe not an immediately fatal hit, push hard to keep the deer moving and to induce rapid bleeding;

9) Old blood is hard to see, but a trained eye can find it;

10) Use gas lanterns or flashlights, plus a partner, if you must trail at night. If rain falls and washes away your blood trail, keep an eye alert for ravens flying above a specific area the following morning. *Joseph Fuqua*

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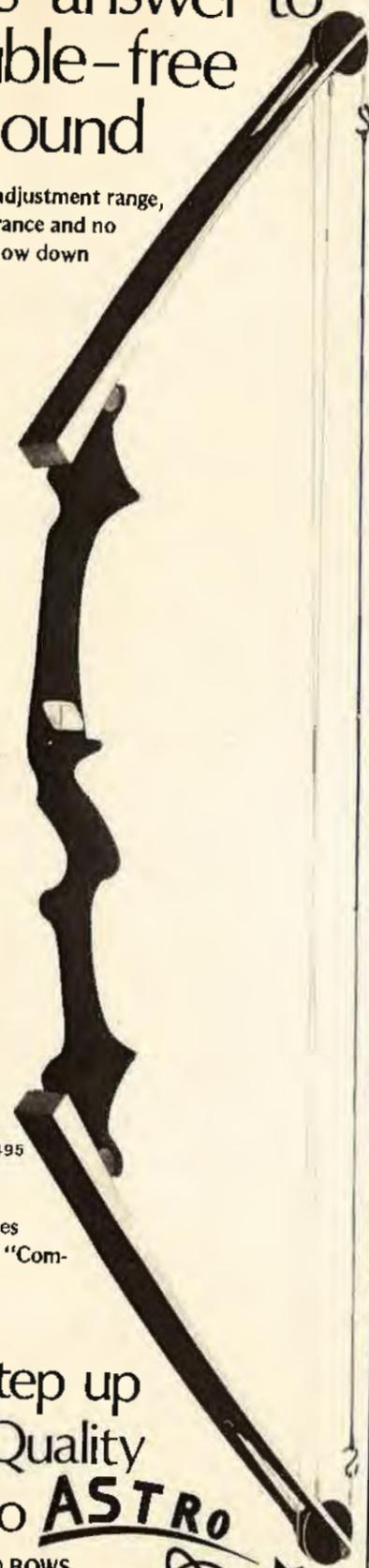
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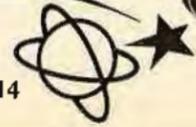
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The Archery Classic and slingshot tournament will be held January 21-25, with shooting on the last three days. Awards include; flight purses of \$10,500 (championship flights, \$5,000; open flights, \$5,500); open team (flights), \$1,800; trophies to amateur teams; \$2,000 in grants to amateur college teams; trophies and plaques to individual amateur competitors; trophies to Junior Olympic competitors; \$600 (schedule to be announced) for the barebow and bowhunter bonus, plus trophies to the overall barebow and bowhunter man and woman champions.

The FITA round remains unchanged from last year. The face will be four-color, 15.7 inches diameter, shot from 18 meters (19 yards, 1 foot, 9 inches). Scoring: 10-9-8-7-6-5-4-3-2-1. Arrows must cut the line or be solidly in the ring. Round: 10 ends, 3 arrows per end. Rules: NFAA rules apply to the open division, NAA rules apply to the amateur division, NAA College Division rules apply to the college team competition. Time: 2½ minutes per end.

Open team events will be quite changed, with only one flight and an increase in the entry fee to \$100. (Amateur and collegiate team fees remain \$20 and \$40 respectively.) The purse will remain at \$1,800 and will be divided into awards of \$800, \$400, \$300, \$200 and \$100. Teams will be primarily company-sponsored, but any four people will be allowed to compete as a team.



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Desert Inn Classic

The Las Vegas Speed Round will again be featured, basically unchanged from the last Classic. Two rounds will be shot, with the top 64 scores from the first round qualifying for the second. The qualifying round will include ten one-minute ends with archers shooting as many arrows as possible. The final round will be six "shoot off" games on the Saunders flip-flop target, reducing the competitors to 32, 16, 8, 4, 2 and then a winner. The first five games will have three ends each, best two of three winning, one minute per end. (Ties will be resolved by 20-second shoot offs.) The final game will be five one-minute ends. Awards totalling \$2,500 will be distributed, with \$1,000 going to the winner. Registration for this event is \$15, to be paid at the tournament site.

Special bonus prizes totalling \$1,000 will also be given out in various categories, mainly gold awards and Robin Hood awards. The left-handed and several other categories have been eliminated.

Entry forms for all events and hotel reservations may be obtained by writing to the Desert Inn Archery Classic, 7800 Haskell Ave., Van Nuys, Cal. 91406. They must be postmarked no later than midnight, January 4, 1976. You may register in any of the following categories: male, female, over 55 — limited, unlimited, barebow, bowhunter — open division (\$45), amateur (\$15), Jr. olympic (\$5).

Sponsors of this annual event include: Jas. D. Easton, Inc., Martin Archery, Inc., Saunders Archery Company, Desert Inn hotel and *Archery World*. More information on the Archery Classic will be given in future issues of *Archery World*.

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In big country anything can happen. Here's what you should carry, and why, in a

BOWHUNTER'S DAYPACK



by Ray Nelson

THERE ARE MANY bowhunters who never carry a pack. They don't need one, they say.

They get along just fine with a sandwich, apple and candy bar in the right coat pocket, a length of rope, broadhead file, compass, matches, flashlight and bandaids in the left coat pocket, cigarettes, map, pencil and gum in the upper coat pocket, binoculars hanging around their neck, canteen on their belt . . . the original Bulgy Bow Bender who has not yet hung a string on a protruding coat pocket, but who is sure to someday do just that when he least wants to.

I find that a pack of some kind is

almost essential if I'm going to be out hunting all day. First of all, the changing weather I'm likely to encounter in my western hunting areas makes me want a variety of clothing. Early in the morning when the sun has not even begun to lighten the sky in the east the temperature may be around twenty degrees, so I like to wear a down vest or heavy sweater and a wind parka, plus warm gloves and a hat with ear flaps.

Shortly after sunrise I'm inclined to take off the wind parka, and by eight or nine a.m. I'm usually ready to take off the sweater or vest.

In the afternoon I may get rain or wet snow falling, and I'll want a rain poncho; or I may get a lot of wind and feel the need of the wind parka again.

It's virtually impossible to carry a suitable variety of clothing unless you have a pack to keep it in.

I like to have plenty of food on an all-day outing; the pack allows me to carry enough. I also like to carry a little backpacking stove or a can of Sterno for making coffee, hot chocolate or soup. I've made it a tradition to stop for coffee at mid-morning, and I almost always have hot soup with lunch on snowy days. I use a stove made by Gerry, a butane cartridge model that only weighs a pound with cartridge and is quick to set up and use. It's far more convenient than fooling with a wood fire. While the water is heating for coffee or soup, I lean back against a rock and use my binoculars to glass the

Some of the items you will find in a bowhunter's daypack, not including food, for a full day or more of hunting include: left, parka, first-aid kit, map, compass, cup, rope, signal mirror, lighter, pocket knife, whistle; center, one-man tent, rain poncho, hunting knife, binoculars, flashlight, chalk, matches, candle, broadhead file, extra bowstring, extra shooting glove; right, down jacket (in stuff sack), gloves, small sauce pan, backpack stove with fuel cartridge, sterno. Exact pack load will depend on your personal preferences and the region where you hunt. Photos by the author.

area for deer.

Other items in my pack are the miscellaneous things most bowhunters like to have along — extra shooting glove, extra shot-in bowstring, maybe a few pre-sharpened and tape-covered broadheads which can be installed in moments using the stove, a whistle and a mirror for signalling should I become injured, a plastic drinking cup and a miniature sauce pan, a flashlight, rope or nylon cord, chalk (handy for marking a blood trail as I go), hunting knife and pocket knife, first-aid kit, map and compass, candle, matches, lighter, etc.

I consider it very important, incidentally, to have enough gear to be able to stay out overnight if necessary. It's possible to get lost or become injured or pinned down in a bad storm, and a hunter who is out of shouting distance from his camp or car ought to be able to spend a night out in reasonable comfort and safety. Even though you may never get yourself into such a bad situation, you still should be well equipped because you may encounter an injured hunter far from any help and have to stay with him overnight or longer.

PACKS THAT SUIT NEEDS

There are quite a few suitable packs on the market. Most cost around \$10 or \$15; some are considerably cheaper, and some are much more expensive. I started with an Alpine Designs small daypack costing around \$13. I bought a brownish one which I thought would go good with camouflage, but found this color undesirable. Because a pack of any kind is cumbersome when you're making a stalk, I found myself ditching the pack from time to time and then having trouble locating it after stalking a deer. I bought an orange, somewhat bigger model, made by North Face, next, and I've never had any trouble finding it. As a side benefit, I feel comfortable with something orange on my back because the area I hunt has been getting a little crowded recently and I'd rather not be mistaken for a deer.

Most daypacks are made in brighter colors because they are intended for hikers, mountaineers and cyclists. Red, rather than a bright orange, would probably be more suitable for bowhunters because it is easily identifiable to the human eye, but takes on a grayish tone for deer.

If you want camo colors, some of the companies make green and dark brown daypacks. Camp Trails offers a camouflage pattern daypack for around \$13 that is probably the best rig for the bowhunter wanting total concealment.

Whatever daypack you select, you'll find it a handy tool for improving your hunting, and less trouble than overloading your pockets with food and gear.

Accuracy At Your Command Dyn-O-Mite Arrow Rest

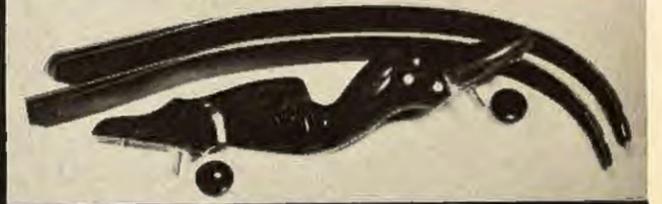


The Dyn-O-Mite arrow rest is flexible and adjustable tough, for either right or left hand shooting. This rest has three settings for in and out control of the arrow's flight. A spring adjustment will provide even up and down adjustment. With the arrow rest mounted to the rear, approximately 4" overdraw is available. Because it attaches with a cushioned adhesive backing in about 60 seconds, no "Burger Button" is needed. It is also legal for Bare Bow and is 100% adjustable. After many years of trial and error, experimenting with all types of rests, the Dyn-O-Mite rest has been used by top shooters and many others and it has been found to be superior. The Dyn-O-Mite rest has been used in many shoots and has been proven to make a marked improvement in scores. So light weight, yet precision machined to provide a quality accessory for improved shooting. Patent Pending.

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Pat. No. 3,493,000

ARCHER'S INFORMATION SERVICE

This page is designed to help you, the target archer and/or bowhunter, conveniently obtain product information about a host of archery items. Most material is free; some items have a small charge.

Simply circle the appropriate numbers on the bound-in card which faces this page and mail that card. Please do not circle more than 25 items. If you note more than 25, your card will not be processed.

We will forward your requests to the proper agencies for fulfillment. If there is a cost for one or more of the printed items you want, please enclose payment with your card. Make checks or money orders payable to each company offering the item you want.

1. Free brochure and order blank on Port Orford Cedar arrow shafts with "Penna-Seal" from **Acme Wood Products**.

2. **Allen Archery Co.**, who holds the patents and is the originator of compound bows, offers a free catalog on their bows.

3. Free catalogs and price list of a variety of bow case sizes and styles from the **Allen Company**.

4. Free discount catalog from world's largest supplier of top name archery brands from **Anderson Archery Corp.**

5. Free pamphlet on their bow sight and arrows from **Archie's Archery Shop**.

6. **Astro Bows** will send you a free brochure on their complete line of compound hunting and target bows.

7. **Baker Manufacturing** has a free brochure on their climbing tree stands, hand climber, wire saw, safety belt, gambrel and strap assembly.

8. **Barner Release Co.** offers free information on their patented competition and hunting releases, including their newest model 252 and standard model 100, both field tested.

9. **Bear Archery** will send you a free brochure on their Alaskan and Tamerlane II compound bows.

10. **Bingham Archery** has a fully illustrated catalog describing semi-finished and finished bows, plus arrows and shafts, and archery accessories. \$1.00

11. Free information on hunting sights, adjustable arrow rests, cushion plungers and other accessories is available from **Bob's Precision Engineering (BPE)**.

12. **Bowhunter's Paradise** has free material describing the use of their tree stand hunting safety belt.

13. Free 1975 bowhunting catalog available from **Bowhunting Suppliers**, offers information on their bows, arrows, and accessories.

14. Price list on current and discontinued broadheads is available from **Broadhead Specialty Services**.

15. **Browning's** catalog has 112 pages of archery equipment, guns, boots, clothing, plus expert archery tips. \$1.00

16. **Calmont Archery Targets** has free literature on their specially-made cotton targets.

17. **Carroll's Archery** has free brochures and other literature on their complete line of archery equipment.

18. **Chicago Archery Center** will send you a free catalog and price sheet of archery tackle and accessories.

19. **Covy Corporation** offers a free brochure on their Covy Arrow Straightener. Also, price lists are available to dealers.

20. Free brochures and price list information on their crossbow models and accessories is available from the **Crossbow Agencies, Ltd.**

21. **Cupid Archery**, manufacturers and distributors of archery equipment

in Canada, offers a catalog of their archery line. \$1.00 refunded on first order. Catalog free to dealers when requested on letterhead.

22. Free catalog describing **Sure Kill Buck** and **Apple Lure**, plus other items, is available free from **Deer Run Products**.

23. A free brochure describing the **Dodd Release** is available from **Dodd Archery**.

24. **Easton Aluminum** has three free brochures — "How to Attack Nocks," "How to Attach a Bowstring," and their **Visual Comparator** arrow spine chart.

25. **Easy Up Tree Stand Company** has a free brochure describing the use and setting up of their tree stand.

26. **F/S Arrows** will send you free, a catalog of their merchandise.

27. **Feline** will send you a catalog showing all major tackle and accessories. \$2.00, refunded on first order.

28. **Gazzara** has a free instruction sheet and descriptive literature on his release.

29. A brochure describing the **Fox Squirrel Climbing tree stand** is available free from **Georgia Archery & Sport**.

30. **Gordon Plastics** has free information on their **Glashafts** and "Botuff" material, plus a price list.

31. **S. C. Graham Sales** will send you free information on their tree climbing steps and other accessories.

32. **Herier's** big catalog covers all equipment an archer needs, plus hunting, camping, fishing supplies and more. \$1.00 refunded with first order.

33. **Hobby Haven** has a free instructional sheet for their shooting release.

34. **JC Manufacturing** will provide a free price list and other information on their nock points.

35. **Jennings Compound Bow, Inc.**, has free information on all their compound bows and accessories.

36. **Jet Aer** has a free brochure on their complete line of sportman's knives and deer lure.

37. **Kwikew Kwiwer** has a catalog sheet available to distributors.

38. Free brochure and dealer price list about their portable tree stand from **Loc-On Co.**

39. **Marco's Enterprises** has a new hunting tips brochure, "What Every Deer Hunter Should Know." 25 cents

40. Several styles of archery t-shirts are available from **Melrick Printing**, who will send you a complete price list and order blank.

41. **Mohawk Archery Products** has product information on their **Magnum I** and **Magnum II** broadheads.

42. **The Don Moss** broadhead sharp-

ener is described in a brochure, available at no cost.

43. **Flipper Rest** attachment and use information is available free from **New Archery Products**.

44. **Nirk Archery** has free information on all their products.

45. **Nock-Rite** has information about their bowstring attachment which can be used in place of a shooting glove.

46. A catalog of their complete line of archery equipment is available free from **North American Archery Distributors**.

47. **Old Master Crafters** has a complete price list of their raw materials for use in building your own bow.

48. **Ben Pearson** will send you a free catalog on their full line of archery products.

49. Free eight-page **Glas-lite** archery catalog, plus information on their new **Switch-A-Head** arrow system is available from **Plas/Steel Products**.

50. **Potawatomi** has a free brochure and other literature on the use of their bow square, bow holder and other archery items.

51. **The Professional Bowhunter's Society** will send you membership information, free.

52. **Range-O-Matic** will send you free information on the use of their **Range-finder sight** and **Spin Wing** vanes.

53. **R & D Products** has free information on their new **Model 70 Arrow Holder** and the **Nelson Arrow Holder**, plus their variety of bowfishing arrow points.

54. **Pete Rickard's** 16-page booklet, "Blinds for Deer Hunters," well illustrated, is available for **50 cents**.

55. **Dickie Roberts** will send you free flyers on each of his bows, plus other archery product information.

56. **Robin Hood** authorized dealers offer the finest in archery pro shop services. They will send you a free listing of the dealers in your state.

57. There's free literature available from **Rocky Mountain Archery Mfg. Co.** on their 8 different models of compounds, including the new economy compound, **Rambolay Hunter**.

58. **Rogue Basin Developers** has a free sighting guide plus information on their bow release, arrow rest and other items.

59. Free discount price list on broadheads, arrows and hunting equipment is available from **Roman Archery**.

60. Get a free brochure on **Port Orford cedar shafts** and price list from **Rose City Archery, Inc.**

61. A brochure and price list, covering **Russ Boot Company's** complete line of boots is available free.

62. **Saunders** offers a free 20-page booklet "How to Have a Successful Bow Hunt." Covers hunting tips, bow tuning, safety, equipment care, broadhead sharpening tips and more.

63. **Savora Archery** will send you information about their new **Super-S**

broadhead.

64. Free literature available from **S & K Mfg.** on their new **Scope Chief**, hunting arrows, hunting releases, camo clothing, plastic vanes, and other items.

65. Free catalog of hunting and tournament equipment, also describing special club discount plan, is available from **Southeast'n Archery**.

66. **Sportronics** has free descriptive literature on history, manufacture and prices of their lighted sight pins.

67. **Sprandel** will send you their new **Bowhunting Specialties** catalog of hunting bows and accessories, \$1.00 refunded with first order.

68. **Stag Manufacturing** has a free brochure describing their various tree stand models.

69. **Stemmler Archery** offers a free catalog covering their new hunting bows and related items.

70. **Sweetland Products** has a free brochure on screw-in adaptors, arrow points, fish points, fur tracers and other items.

71. **Texas Feathers** offers a brochure and price list on their **Bright Way** ground base feathers.

72. You can get free literature describing their new target and hunting sights from **Toxonics**.

73. **Triple D Tiplite** will send you descriptive material and photos, plus pricing information for pro shops, dealers and distributors.

74. **Trojan** will send you a new catalog of their complete line of archery tackle and accessories, free.

75. **Trueflight** has free information on their brush buttons, string silencers and feathers.

76. **Ultra Products, Ltd.** will send you a free copy of their "Spirit of '76" catalog, 75 pages of hunting and target product information.

77. **WASP Archery** will send you free descriptive material on the **WASP** compound bow and broadheads.

78. **Western Archery Sales** has information about their **Rain-Bow** hunting sight.

79. **Whiffen** will send you a free catalog describing all the archery accessories it offers.

80. Handy and useful archery accessories are shown in a free catalog from **Wilson-Allen**.

81. **Wilson Brothers** will send you free information about their **Black Widow** line of tournament and hunting bows, plus their "Arrow Flight Control" rest and other items.

82. **Wilson-Precision** has free information about their new rotary releases.

83. **Wing** will send you free a colorful 21-page catalog showing their full line of bows, youth sets, arrows, accessories. They'll also give you a list of **Wing** films you can rent.

84. **Zenith Thread & Throwing** offers free information on their miracle strength **Kevlar** bowstring material.

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The Competition II has won the 1973 Nebraska State Championship, the 1974 and 1975 South Dakota Pro-Am, the 1974 Lincoln Pro-Am Championship, the 1974 and 1975 Nebraska Indoor Professional Championship, the 1974 Phoenix Open, the 1975 Archery Super Starshoot, the 1975 Big Banana Open, the 1975 US Open Women's Instinctive, and the 1975 American PAA Indoor League Championship. You could be next with Competition II on your side.

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Colors: Magnesium riser in ivory, blue, or black. Glass in ivory (under 45-lb weight) or black (45-lb and over).
Options: Wing stabilizer, sight extension, cushion plunger, padded case, bow stringer.



Box 1930, Route 1, Jacksonville, Texas 75766

THE VALUE OF A SHARP BROADHEAD

Razor sharp broadheads are more effective on good hits . . . and more humane on superficial hits. Here's why.

by Judd Cooney

HOW MANY BOWHUNTERS do you know who have the best of equipment, spend hours in the field studying game and its habits, and then ruin the whole picture of a real knowledgeable outdoorsman when on the opening day of bow season, they venture forth with a set of fresh "out of the package" broadheads that are not much sharper than a field point. Maybe if you are downright honest, you are in this category; more than 50 percent of the bowhunters are, I believe.

Broadhead sharpness is usually a key discussion topic when any group of bowhunters get together, but I wonder just how many bowhunters really understand what a SHARP broadhead is and how it works.

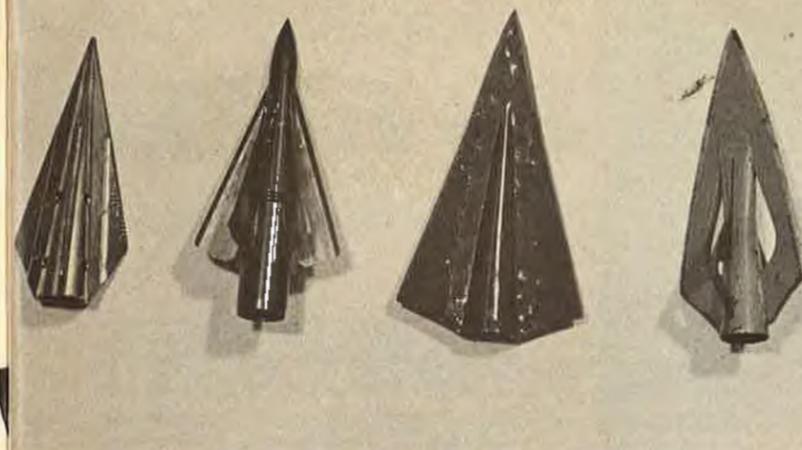
In my estimation, a broadhead that is not sharp enough to shave the hair off your arm in one stroke shouldn't be taken into the field after big game. I know there are many bowhunters who advocate that file sharpened broadheads are superior to a honed and stropped one, but these bowhunters are just taking the easy way out.

I realize that there have been thousands of big game animals killed with file sharpened broadheads and there will undoubtedly be many more, but before



*Under the skin there are two, sometimes three, opposing layers of muscle. If the broadhead does not make a crosswise cut through all layers, the layer that is merely sliced lengthwise will pull shut and prevent a blood trail.

*Left broadhead has been stone honed; right broadhead has been file sharpened. Note the smooth, slicing edge of the stone-sharpened head.



*Blade numbers and designs vary. Choose one which flies and works best for you.



*Good hit, sharp head brings a trophy in seconds.

you quit reading in disgust, why not give my arguments some thought before mentally telling me to go to hell.

As we should all know, a broadhead kills by hemorrhage, which means the animal literally bleeds to death. Most bowhunters I have talked with will tell you that an arrow kills without shock, but this is not quite true.

Doctor Bruce Stringer, a good friend of mine, who is director of the Albuquerque Zoo, has probably done as much or more work on the shock effects of arrow hits on game animals than anyone. Dr. Stringer is a doctor of veterinary medicine and an avid bowhunter. His vocation and avocation have given him many opportunities to autopsy bow killed animals to determine the full effects of arrow hits. He has done most of his work in Albuquerque but has also spent several years in Africa where he had the opportunity to work with many of the African game species. Dr. Stringer contends that there is considerable shock imparted by an arrow when it hits an animal. The shock from an arrow is nothing like the shock delivered by a rifle bullet traveling 10 times as fast, but nevertheless, there is still considerable shock to the animal's system.

When an animal is hit with a broadhead tipped arrow, a whole series of events take place immediately to stop the flow of blood from the wound or wounds. The more shock involved the stronger this reaction is.

The immediate reaction to shock is vaso-constriction of the blood supply system. This means that the vessels and capillaries close down and reduce the flow of blood to the wound site, thereby slowing blood loss through the wound. At the same time, there are numerous chemical reactions in the blood itself, much too complicated to go into here, but the end result of these reactions is that blood platelets start to clump and adhere to the vessel walls at the injury site, further reducing the flow of blood. If the shock is severe enough and the

wound of the right type, the bleeding will be stopped completely.

Here is point one in favor of a razor-sharp broadhead. The sharper and smoother the cutting edge, the less shock to the animal's system and the less vaso-constriction, which means bleeding is more profuse. The cleaner the edges of the cut, the less surface area is exposed for the blood platelets to adhere to and further impede bleeding.

I have discussed hemorrhage and bleeding with several doctors and learned some rather surprising facts. Twenty years ago doctors had much less of a problem with hemorrhage and extensive bleeding during operations than do our present doctors. There is a very definite reason for this problem that should interest you as a bowhunter.

SHARP HEADS, BETTER HEALING

Years ago the scalpels used for operations were hand sharpened and used over and over again, and many times the same scalpel would be used for the whole operation. The vessels and capillaries that were cut by these rough sharpened scalpels would seal off very quickly and stop bleeding. The scalpels used in an operation today are all the disposable blade type, and in many cases only one cut is made with a blade and then it is disposed of so it never gets the slightest bit dull. These cuts are exceptionally smooth and clean and there are no ragged edges to seal quickly, so they have a tendency to bleed more freely.

Another very important factor that also gives the razorsharp edge the vote is the healing factor. Years ago during an operation, infection was a major factor because of the relatively ragged edges of the cuts due to dull or roughly sharpened scalpels. The ragged edges of a cut can harbor infectious organisms and the rough edges of the cutting instruments carry minute particles of dirt or foreign material into the tissue and thereby create sites for infection to set in. With a clean, smooth, free bleeding wound site, the flow of blood

helps to wash out any foreign particles and the cut itself has fewer areas for infectious organisms to find a hiding place, thereby causing a superficial wound to heal faster and minimizing the chances for infection.

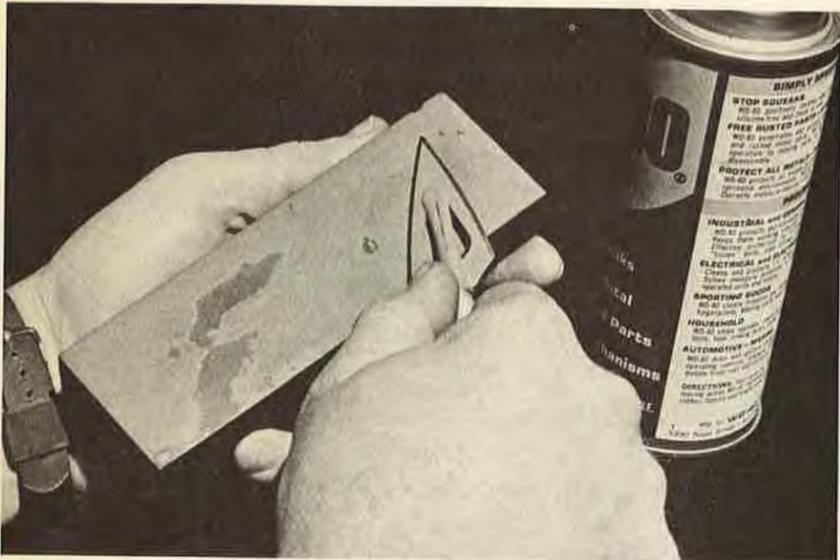
On one hand we have a broadhead with a clean, smooth-honed and stropped RAZORSHARP edge and on the other a broadhead with file marks and a ragged "feather edge," thought by many bowhunters to be the finest type of edge for taking big game. The smooth RAZORSHARP blade hits the animal and slices its way through hide and hair, then through vessels and tissue, cutting cleanly and creating very little shock to close the blood vessels and capillaries. The wound bleeds freely leaving the bowhunter a good trail to follow and if it happens to be a non-vital hit, the wound will eventually seal off and heal quickly with very little, if any, infection leaving the animal to roam the woods for another day.

The ragged, file sharpened broadhead on the other side of the picture, hits the animal and in the process of going through the hair and hide, manages to snag a good portion of hair, dirt and tough hide in the "feather edge" and jagged file marks. By the time it has penetrated through the hide and hair, much of the ragged feathering is either taken off or so filled with tissue and fascia along with a gob of hair that it will no longer cut cleanly so it snags and rips its way through vessels and muscles creating a large amount of shock to the animal and leaving rips and tears rather than clean cuts. The shock shuts down the blood supply and the ragged wounds quickly seal off the blood flow, leaving the hunter to guess which way the animal went because there is no more blood trail after the short, initial bleeding. In the broadhead's travels through the tissue of the animal, it has deposited a lot of foreign material throughout the wound channel and if the hit was non-vital, infection will

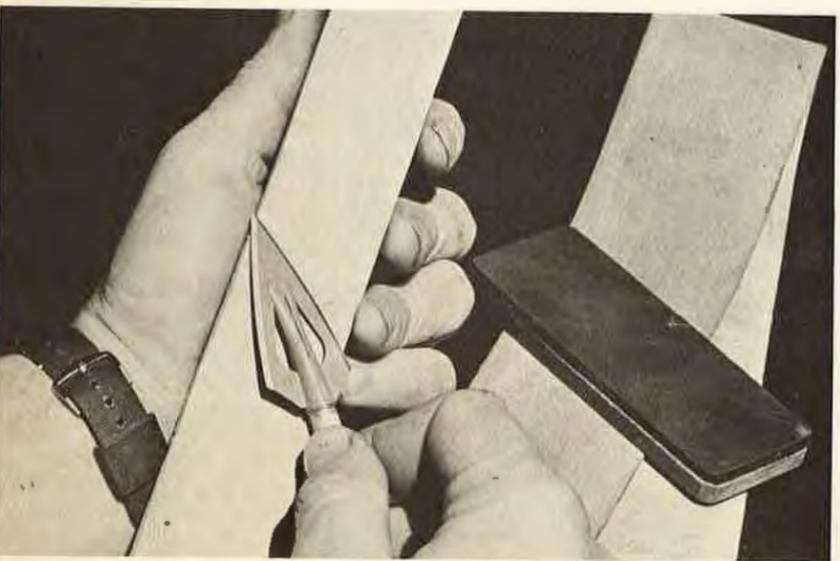
(continued on page 54)



●After screwing new broadhead into shaft-handle for ease of holding, file all tool marks from blade trying to keep original angle to the blade.



●Using plenty of lubricant, stroke into the center of the blade, trying to take a thin slice from the medium grit stone. One stroke toward you and one away, 10 or 12 times, will put a good beginning edge on the blade. Repeat this procedure with the fine stone and then the razor hone, which is the hardest stone of all.



●Then strop the blade on a piece of leather, such as this one glued to a plexiglass strip. This removes the fine burr edge and polishes the blade. Strop away from the ferrule, not into the blade as you did with the stone. Other strops shown are a razor hone with a leather strip on the back and the other is an old barber's strop.

How to put a RAZOR

by Judd Cooney

"A RAZOR SHARP broadhead in less than two minutes . . . you gotta be kidding!" This is the comment I usually get from fellow bowhunters when I make the statement that I can take a new broadhead out of the package and in two minutes have it sharp enough to shave cleanly with.

Broadhead sharpening is no deep, dark mystery as many bowhunters believe. All it takes is a little patience, lots of practice and the proper type of equipment. When I first started sharpening broadheads, it was more or less luck when I got a properly sharp head. I'd work on a broadhead 10 or 15 minutes and perhaps when I finished, if everything was right, it would be sharp enough to shave with. Most of the time it had a rough edge, flat spots and would just barely cut. It was much easier, and at the time seemed much better, to take a file and simply file-sharpen the blade, leaving a feather edge, which felt sharp to the touch but was actually an edge on the steel instead of in the steel. This is an easy way out that many bowhunters do take, but a properly sharpened, razor sharp broadhead is much superior to a file sharpened broadhead any day.

Today's bowhunter really has it made as far as getting a sharp edge on if he has the inclination or talent for sharpening a broadhead. There are several very fine sharpening jig type tools on the market. One is put out by Buck Knife Company, Box 1267, El Cajon, Cal. 92022 and another by Razor Edge Company, Box 2031, 932 S. Layton Blvd., Butler, Wis. 53007. Both of these provide you with a set of sharpening hones or carborundum stones, plus a jig, or little vise-like arrangement to hold your broadhead. With these, it's hard to make a mistake, although even this outfit does take some practice to get the proper edge on a blade.

Over the years, I have developed a method that I believe produces superior results to these in less time if you, as a bowhunter, have the patience to practice and work at it.

The proper equipment is one of the main things in getting a razor sharp broadhead. For sharpening your broadheads, you are going to need the following items:

EDGE on a broadhead in less than two minutes

1. A setup or a piece of arrow shaft on which to hold your broadhead. My broadheads are all screw-in type broadheads, so I have used a piece of aluminum shaft material, about six to eight inches long, with a screw-in insert epoxied into the shaft and the handle taped up so I can hold it. This is to hold the broadhead while you are sharpening it, so you don't have the feathered end of the shaft waving around and giving you an improper angle on your broadhead.

2. A good, flat, mill file. Either six- or eight-inch is an ideal length, as this is easy to transport and carry along with you in your bow quiver or in your belt pouch.

3. A medium grit, carborundum stone, which can be bought at any hardware store. The one I use, and have used for several years, is a double grit type and works very well for broadheads. You will also need a fine stone which can also be purchased in most hardware stores or through any bowhunter supply.

4. A hard Arkansas stone to put the finishing touches on the blade.

5. Probably the most important piece of equipment is a leather strop or piece of leather to polish the final edge on your broadhead. A good leather strop can be purchased through a catalog, although right now they are rather hard to come by and fairly expensive. You might make a trip to your local barber and see if he has one that is worn out. This would be fine for broadhead sharpening. The one I use is an old barber's strop that I have sandpapered to give it a rough finish. This really polishes the edge and puts that final touch on a broadhead.

Another piece of equipment I have been using lately is a small razor stone with a leather strop glued to the back of it. This razor hone and strop is small enough to be carried conveniently in a belt pouch for touching up broadheads while in the field.

The first step in sharpening a broadhead is to either screw the broadhead into your shaft-sharpening handle or slip it over the tapered portion of a wooden

(continued on page 56)



●Photo on left: A well sharpened broadhead with the edge in the steel will hold a better edge. This head went completely through a bull elk, including a rib, and will still shave hair from the author's arm. Photo on right: Author's sharpening kit includes broadheads, piece of shaft for handle, flat mill file, leather strop, sharpening stones (left to right) medium grit, fine grit, WD-40 used as lubricant, fine razor hone with strop on reverse side and hard razor hone. Razor strop is in top of box. All this is kept in small fishing tackle box for carrying convenience.



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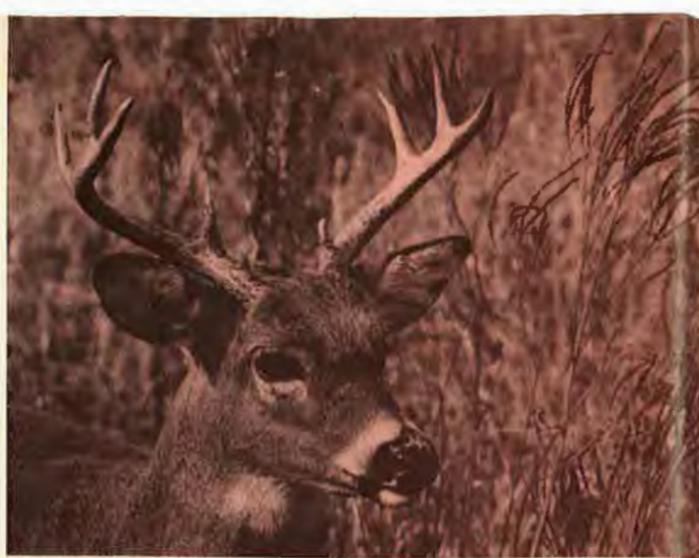


photo by Leonard Lee Rue III

sniff, snort... whiff of good bowhunting

by Glenn Helgeland

WHEN GENERAL Cornwallis handed his sword to General George Washington at Yorktown, thus ending the American Revolution, the British band played an appropriate tune called "The World Turned Upside Down."

Someone could play the same tune for the deer hunting land in southwestern New York, down around Hornell, and it would be entirely fitting.

The soil there must be highly impervious, for there are swamps atop many of the ridges . . . tamaracks and tag alders thrive high on many ridge slopes . . . every so often you'll find a pond on the brow of a ridge. And down in the valley bottoms — where you would expect to find the swampy stuff — you'll find narrow, swift-running creeks bubbling along rocky beds with not an ounce of mud or spear of skunk cabbage in sight. Sumac and goldenrod and a few rugged black walnut trees grace the bottoms and sides of these hollows.

It takes a while for this seemingly topsy-turvy setting to sink in; but when it does, you fully appreciate the special beauty of this deer-rich hunting land. For as any outdoorsman knows, the simple joy of seeing new land is a great part of any hunting adventure, no matter how typical or mundane it may seem to the people who spend their lives there.

Thus, when you hunt with people who know and appreciate the uniqueness of their home territory, you get a bonus.

We did, when we hunted last fall with Dave Young, Niagara Falls; Larry "Old Smeller" Nowicki, West Seneca; Neil Edwards, Ravena; Gordon Webber and his son, Tom, Niagara Falls; and Derek Wardle, St. Catherine, Ontario.

The days hadn't been clearer than a slight drizzle for the entire week before our November 6 arrival, so the ridges were weeping profusely down every side road and every brushy little draw. Fog curled in heavy clouds over the valley bottom farmland, filling it and softly climbing along the ridge benches almost to the tops, much as a loaf of unbaked, overrisen white bread spills up out of the pan.

And there we were, walking the ridge tops and upper flanks — Dave with somewhat of a limp because without checking he'd grabbed a pair of rubber insulated boots that were both for the right foot — searching along the edges of winter wheat fields for fresh tracks and signs of feeding. Now and then the silence was broken by the muffled early-morning crow of a rooster down below the fog blanket, or the softened snorting of a tractor as a farmer wheeled out for a day's work.

Our own silence was broken now and then by a loud "Whew!" from whoever had inadvertently walked into the downwind trail from Larry. Back at camp, he had liberally doused his camo hat and shirt with buck scent — "Can't have too much of it because it really hides your scent," he had said, in answer to a question — and then squirted some on his shoes for good measure.

The ridges are heavy with beech and oak, with scattered areas of white pine, spruce and tamarack. Sumac thickets climb the ridge flanks in many places, and goldenrods, so thick you must struggle through them, have thoroughly blanketed forgotten agricultural fields and gullies and ridgetop niches.

But this year the oak trees yielded little deer food. Ordinarily, deer will walk along the benches of ridges, completely hidden from an intruder above or below them on the ridge, and feed heavily on the acorn mast as they move.

This year, however, they were paying more attention to the winter wheat — "The first time in a long time I've seen that," Dave said — and the still standing cornfields too wet to harvest, grass in the goldenrod fields and beechnuts where they could find them. A tough freeze a few weeks before had killed all the apples, and they had fallen and been eaten by the time we arrived. We spent little time in the orchards.

But the big-shouldered, brooding ridges, lying there dark, sullen and silent, held heavy promise. The farmers of this area of the southern hunting zone of New York State frequently

(continued on page 58)



•Goldenrod and brush make excellent deer hiding areas.



•Judy and Larry head back from morning stands. That's fog in the background.



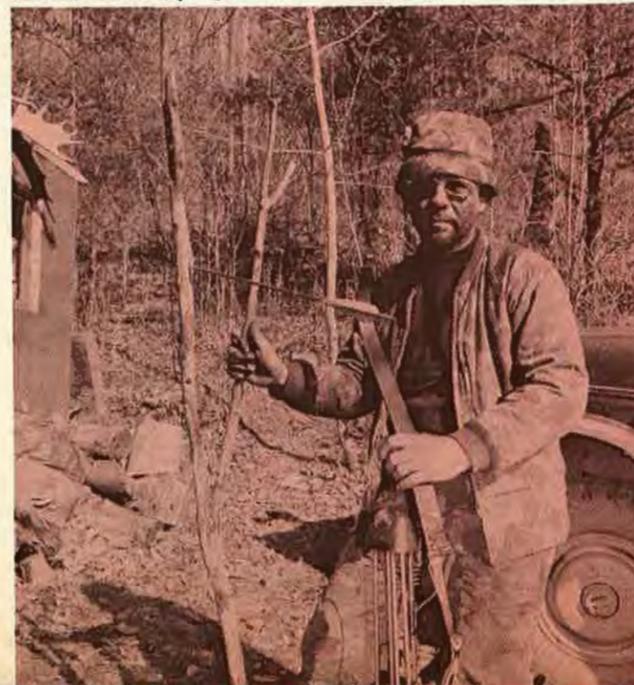
bottom five photos by Glenn Helgeland



•Larry, Neil and Dave carry out the doe Neil shot in a wheat field just before dark.



•Dave helps Judy get set on the edge of a wheat field.



•The Pole-killed pole, shot through the heartwood by Larry Nowicki. The deer is still laughing.



•Tom McEachern and Mel Mueller, wearing hat, compare trading heads in hopes of enriching both their broadhead collections.

**“Have you
lost your marbles?”
“Yes, but I FOUND
five old broadheads.”**

**No one has yet collected all 600-plus
heads commercially manufactured,
but some collections have reached 400.
A lot of the designs aren't as new
as you may have thought.**

by Glenn Helgeland

OVER THE YEARS, more than 600 different broadheads have been commercially manufactured and sold.

“At the time each was put on the market,” says Bill McCrary, Madison, Wis., president of the American Broadhead Collectors Club (ABCC), “every manufacturer thought he had the best broadhead ever designed.”

Such is the stuff of metallic and plastic dreams and realities. Some heads are still available, some have gone the way of the dodo and the dinosaur, and undoubtedly there are many others still on the drawing board waiting to spring into existence.

Broadhead collectors today grind their teeth a bit when they think of all the old broadheads that disappeared on the business end of woodchuck and squirrel arrows. The heads were just throwaways, so they might as well be put to some use. Draw, anchor, release and gone forever.

Ernie Boyd, Lincoln Park, Mich., laments, “I know one manufacturer who dumped barrels of old heads in the trash. If I could have found where the garbage collectors took them, I'd have gone looking.

“Man, barrels of them. . . .”

Ernie did strike it right in one instance. “I came across 18 old two-bladed heads of an unknown name. Right after that I found out that only about six other guys in the U.S. knew about this head style. A couple of other collectors got awfully excited when I mentioned them. They're good trading heads, so I've hung onto most of them.”

ABCC members are attempting to stay away from monetary transactions for old heads. “That puts the emphasis on how much you're willing or able to pay for a head, and takes away from the fun of hunting it down and finally finding it,” they say. But they will trade or give away extra heads. Floyd Eccleston, Mt. Pleasant, Mich., gave 125 heads to a guy “just to help him get started.” Floyd has more than 400 broadheads in his collection.

One of the best of the old broadheads is the Kiska manufactured by Roy Case. Roy began production in 1927. The first 10 deer killed under modern bowhunting laws in Wisconsin were taken with the Kiska.

There has been a significant evolution of broadheads over the years, McCrary points out. The tapered ferrule began about 1939 when Zwickey introduced the combination of a broadhead with a matching field point which could be fitted on the same shaft.

Early heads were basically two-blade design. Zwickey also had an early four-blade design with an “opened up” ferrule. Then came a patch-on four-



•In top photo, Ernie Boyd, left, and Bill McCrary, look through Ernie's boxful of traders. In bottom photo, Floyd Eccleston shows Larry Whiffen some of the heads from his 400-plus collection.

blade like the Smith. The insert blade followed, with the Bear Razorhead probably the most well known style.

The screw-in, or convertible, head is not a new idea either. Ralph S. Kreiger, St. Claire Shores, Mich., designed a screw-in type head and mounting system and filed for a patent in 1938, which he received in 1940. McCrary is uncertain, but he believes this head was only experimental and never placed in production. The Kreiger head is more unique because it was the first three-blade head marketed commercially, around 1940. McCrary believes it was sold only in a design which would fit over the end of a shaft and not in a screw-in design.

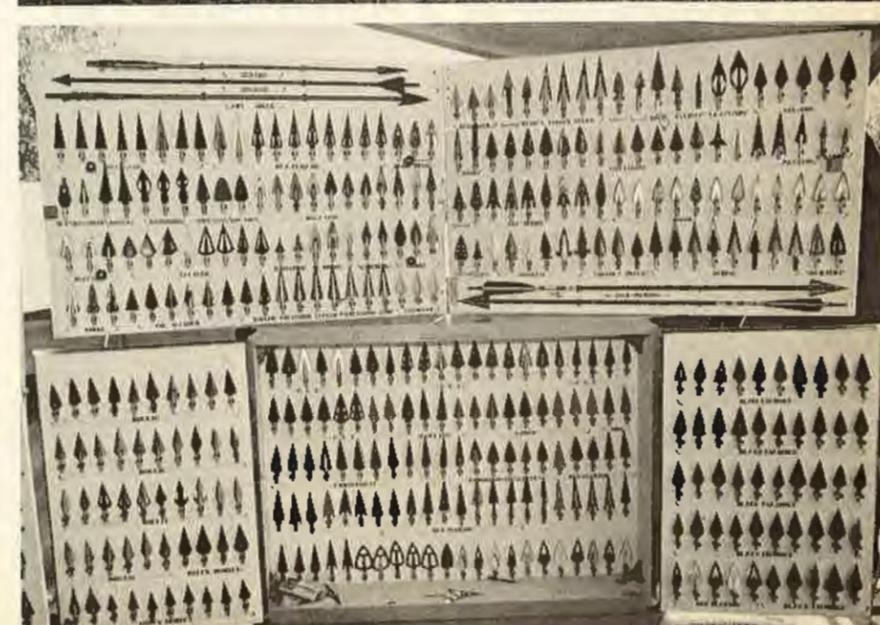
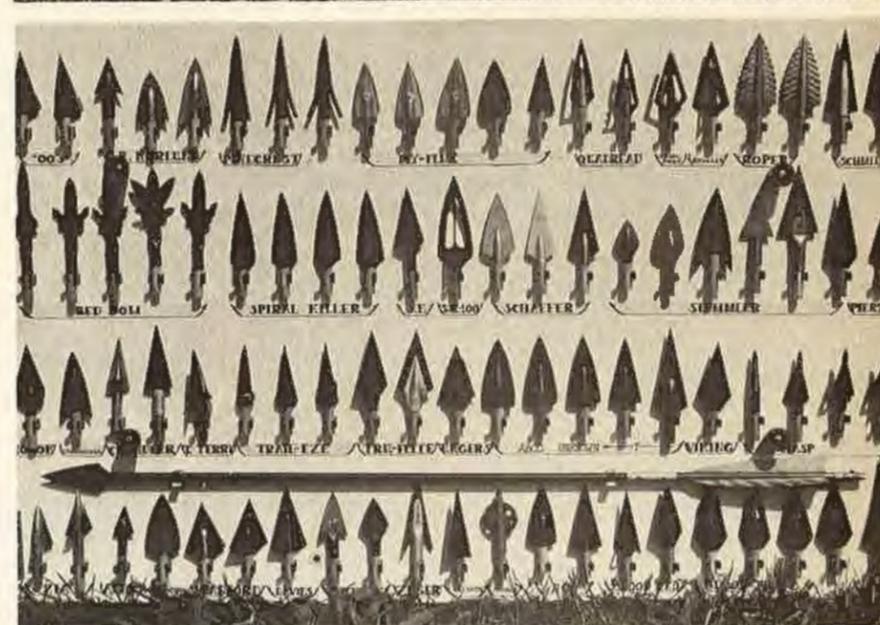
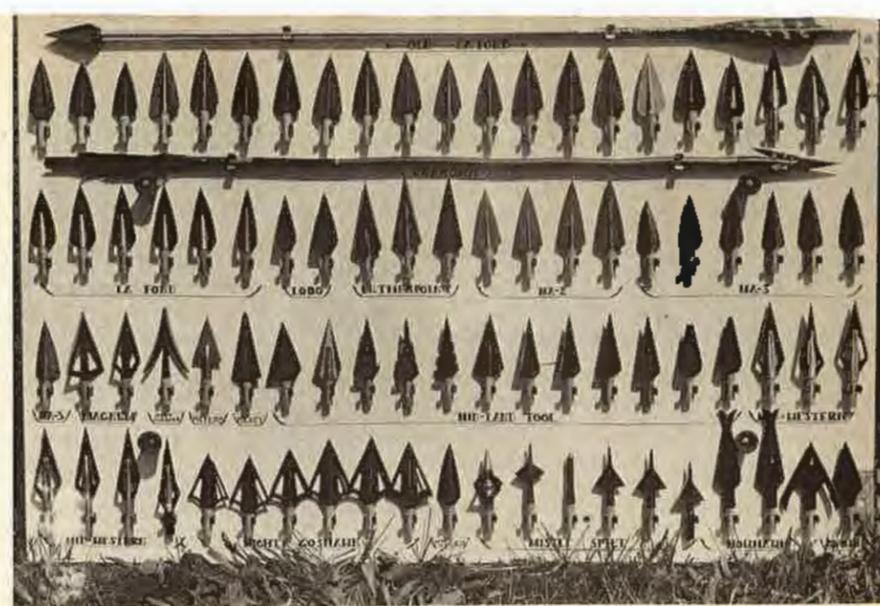
Other early screw-in heads were the T. B. Chandler (two-blade), Ja-Lea (two-, three- and four-blade), Mahler (two-blade) and the Everitt Quick Change.

The use of razor blades as an auxiliary cutting surface began around 1950.

Manufacturers began moving away from the barbed head design around 1940 when Wisconsin outlawed them and many other states copied their laws.

Many people believe the barbed design was used so deer couldn't pull the head out. Roy Case says this is an

(continued on page 66)



•These three photos show a wide range of designs and sizes of broadheads manufactured over the years. All are in Floyd Eccleston's extensive collection.

HOW TO GET THE FASTEST ARROW

Tuning a compound can be tough, so tough that you often feel you must resort to heavier-than-recommended arrows to get satisfactory cable and bow clearance, and thus good flight. To find out how to solve this problem we talked with Pete Shepley, George Chapman and Evan Clarke at Precision Shooting Equipment.

The suggested items all relate to fine tuning for target equipment; many of them, but not all, can also be applied to hunting equipment, especially those which relate solely to equipment setup.

IF YOU'RE A compound bow shooter who, through tuning problems, has been more or less forced into shooting heavier than desired arrows to get consistent arrow flight, you're almost defeating the purpose of the bow.

But with a systematic, almost "cookbook" approach to tuning you can simplify the job, get back down to the lighter arrow weights recommended and thus pick up the speed you should have.

First, last and always you must think "system." This includes the bow, arrow, arrow rest, arrow nock, how the arrow is fletched, your release style and other points. Individually and collectively they all ultimately affect the size — and speed — of arrow you shoot.

One myth that has developed around compound bows is that a super fast arrow cannot be grouped well. Bullroar! If you get good arrow flight, you will group. Speed alone has nothing to do with good grouping; you can't muscle an arrow from bow to target and expect it to shoot accurately if it isn't flying right.

Yes, you can have a poor flying arrow shooting well, but it's usually because the shooter is highly consistent in shooting form. The pressures exerted on the arrow are the same with all photos by Precision Shooting Equipment

each shot and performance is thus relatively predictable.

You ideally want to build the most forgiving setup and attain clean arrow flight, with as little oscillation as possible. You shouldn't be forced into drag stabilizing (with big fletching) an arrow to slow it down and dampen shaft oscillations to enable it to recover in time to hit the same spot every shot.

Let's take a look at the basic tackle arrangements necessary to get clean, fast arrow flight.

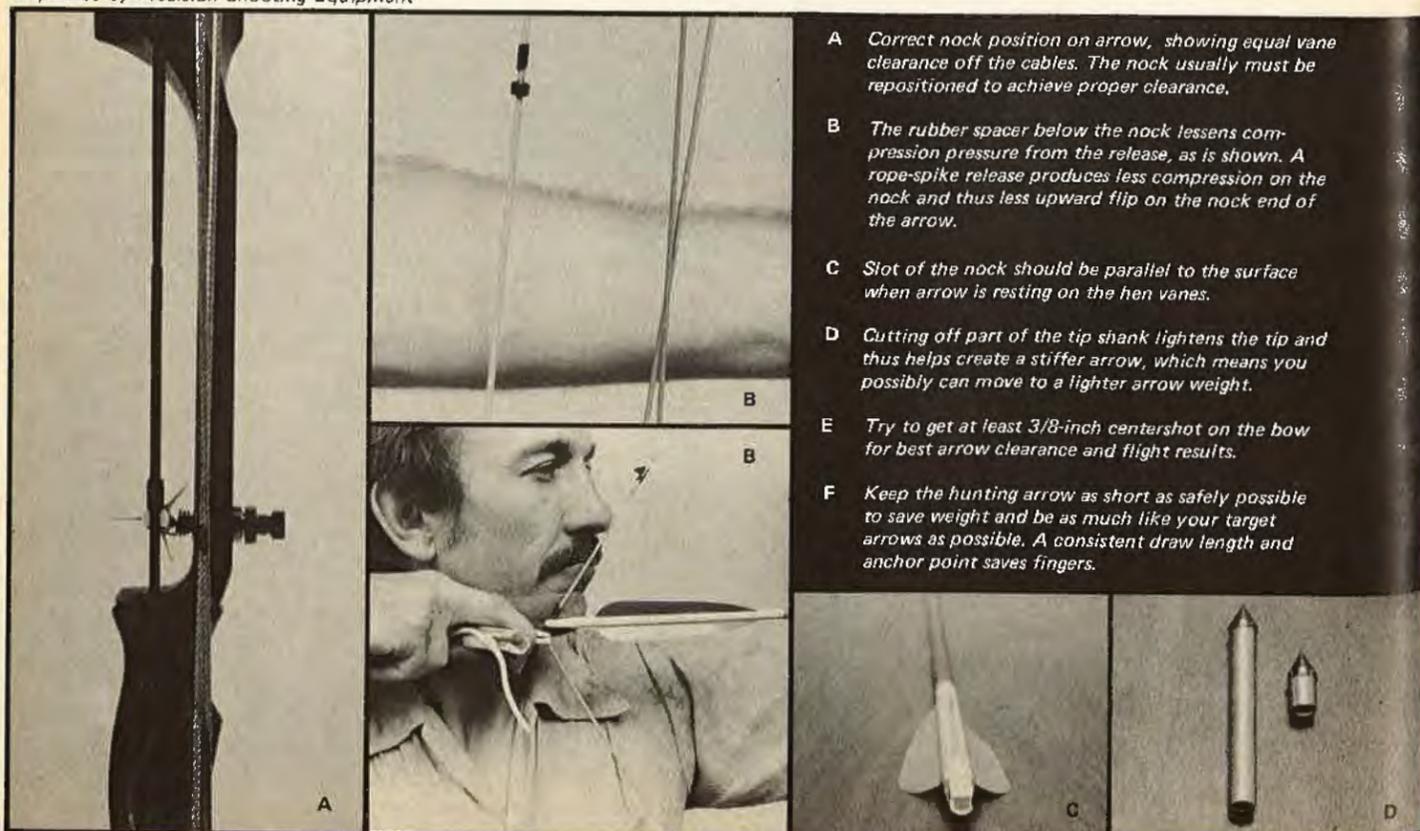
1] **Nock position on the arrow.** Even with the right arrow size, an incorrectly positioned nock will force the top or bottom hen vane into the cable, into the bow or into the arrow rest. Thus, you must have equal clearance on both vanes off the cable. Unfortunately, virtually 90 percent of all arrows have a nock position which turns the bottom hen vane into the cables; you can do all sorts of other tuning tests with these, but if nock position isn't correct you won't get anywhere.

Fletching is very closely tied to nock position. In hunting, you almost always must have some kind of offset, just to spin stabilize the arrow. (There are two kinds of stabilizing — drag stabilizing and spin stabilizing. Feathers have a lot more drag stabilization effect than do vanes because of the increased air resistance. So with vanes you must have some spin stabilization, but only a little is necessary.)

We go with a slight offset, one degree or less, put on with straight clamps.

The helical fletch is bad news for a compound, especially with a big helical wrap. It is extremely difficult to get such fletching past the cables.

As far as the relationship between nock and fletching is concerned, standard fletching jigs position the nock improperly. So unless you buy arrows made especially for compounds you will have to do some repositioning.



- A Correct nock position on arrow, showing equal vane clearance off the cables. The nock usually must be repositioned to achieve proper clearance.
- B The rubber spacer below the nock lessens compression pressure from the release, as is shown. A rope-spike release produces less compression on the nock and thus less upward flip on the nock end of the arrow.
- C Slot of the nock should be parallel to the surface when arrow is resting on the hen vanes.
- D Cutting off part of the tip shank lightens the tip and thus helps create a stiffer arrow, which means you possibly can move to a lighter arrow weight.
- E Try to get at least 3/8-inch centershot on the bow for best arrow clearance and flight results.
- F Keep the hunting arrow as short as safely possible to save weight and be as much like your target arrows as possible. A consistent draw length and anchor point saves fingers.

FROM YOUR COMPOUND

The simplest method is to lay the arrow on a table, resting on the hen vanes, then reattach the nock so the slot is parallel to the surface of the table. This will give the correct hen vane clearance off the cables.

If you shoot right handed, shoot the right wing offset (unless you're using perfectly straight fletching, in which case there's no right/left wing worry). If you shoot left handed, use left wing offset.

With slight offset, this means that the top hen vane will be angling out slightly at the rear and the bottom vane in slightly at the rear. As the arrow goes across the rest, the vane will brush along the side and clear easily. If the vanes are attached the other way, the vane touching the rest as the arrow flies past has to climb up over it. This would give the arrow a tail hop and would seem to indicate nocking point location problems, but that would be wrong. You could thus mess around all day with your nocking point and not get good arrow flight.

(The reason a heavy arrow seems to solve flight problems better in this instance is that the arrow rest won't interrupt its movement like it would a lighter, less resistant arrow.)

An excellent checking system for arrow clearance is to use a can of deodorant spray powder or something like that and spray a light coat of powder over the entire rear 10 inches of the arrow and fletching.

If your arrow is dragging on the arrow rest you will notice a small nick of powder residue, and if the vanes are hitting cables or sight window they'll leave a powder mark there. Don't look for a big splash of powder, just a small line.

2] **Type of release.** A trigger type release imparts least oscillation on the string on release and is excellent for shooting light arrows. The rope-spike release is almost as good for low oscillation, and it has an advantage in that it puts less pressure on the

nock or eliminator button.

If you're using fingers, you automatically impart more oscillation in the string, creating more bending in the arrow, which means it takes longer to dampen out, requiring you to shoot a heavier arrow. But since we're still talking "system," you should go with as little increase in arrow weight as possible.

Finger shooters shouldn't need to go to arrows matched to the peak weight of the compound; you should be able to get good flight from arrows matched to a point halfway between peak and holding weights at your draw length.

Release shooters should be able to go even lighter than this. Some expert target shooters with consistent form and good bow tuning skills have been able to get good flight from arrows matched to the holding (relaxation) weight, and thus shoot lighter, faster arrows.

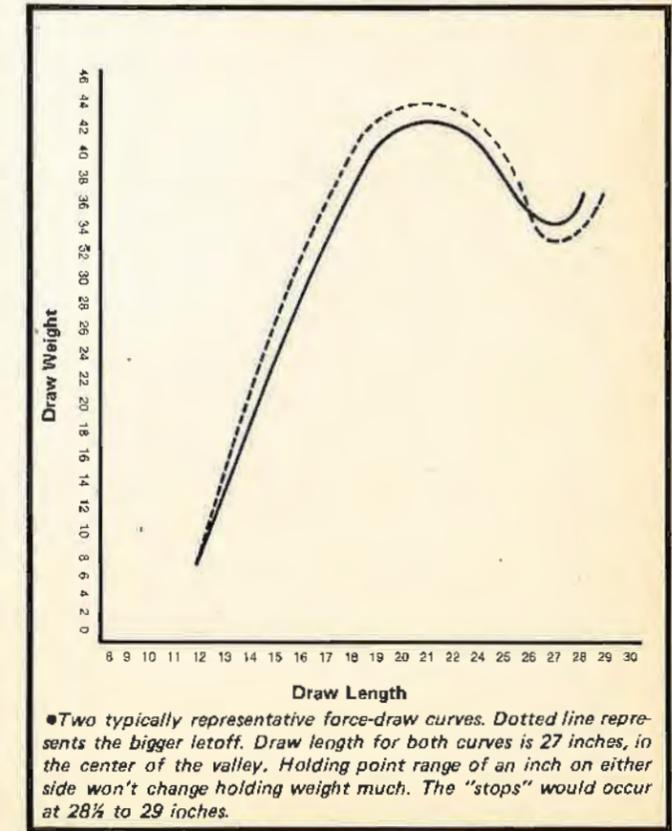
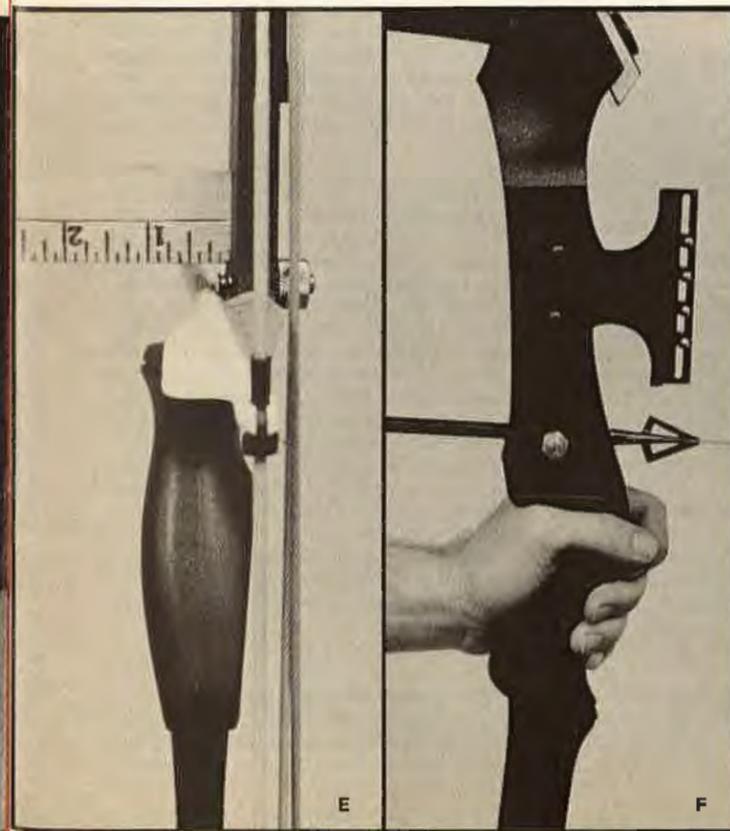
3] **Arrow rest.** This unit is every bit as important as anything else. An ideal arrow rest gives vertical and horizontal (omni-directional) forgiveness. It must be strong enough to give you mental security and give the arrow good support while allowing proper clearance.

We've had good results from coiled spring-type rests, especially when set up with a cushion plunger. There are several weights of wires available, so you can really fine-tune the things. Obviously, the heavier, stiffer wires work best for heavier arrows.

Flipper rests and Pro Flex rests work, too, because they "give." Especially when a shooter has consistent enough form that a cushion plunger can also be used.

You can get any rest to work right, but you want something that will fit best into your shooting and tuning system and will give you the most advantages. Use advanced equipment to the

(continued on page 64)



BOW REPORT: HOYT PRO MEDALIST T/D HUNTER

Manufacturer: Hoyt Archery
11510 Natural Bridge Rd.
Bridgeton, Mo. 63044

Model Name: Pro Medalist T/D Hunter

Suggested retail price: \$145.00

Length: H-16 — 58", 60", 62"
H-20 — 63", 65", 67"
H-24 — 66", 68", 70"

Draw weights: To 70 lbs.

Draw length limit: None

Sight window length: H-16, 5"; H-20, 6"; H-24, 7 1/2"

Degree of centershot: H-16, 1/4"; H-20 and H-24, 3/8"

Handle, limb material: Magnesium alloy handle, fiberglass with laminated wood core limbs

Mass weight: Approx. 2 lbs., 12 oz.

String length: 3" less than callout length of bow when strung

Suggested brace height: H-16, 7-3/4" to 8 1/2"; H-20, 8" to 8-5/8"; H-24, 8 1/4" to 9 1/4"

Arrow rest: Hoyt Super Rest

Special fittings: Drilled, tapped for stabilizers, bow quiver, bow reel

Handle style: H-16, medium wrist; H-20 and H-24, attached grip in medium, medium-high

Standard equipment: H-16, string and rest; H-20 and H-24, pair of stabilizers

Limb widths: 1 1/4" at base

Finish: H-16, crackle enamel handle; H-20 and H-24, high gloss epoxy handle; limbs, conversion varnish, buffed

Guarantee: First year unconditional, next two years prorated



THE BOWS

THIS TAKEDOWN BOW is built around three lengths of magnesium alloy handles and a family of matched limb sets. The limbs are interchangeable among the three handle lengths which are designated H-16, H-20 and H-24, denoting the approximate length in inches. A given set of matched limbs will assemble to any of the three handles, providing assembled bows of three different lengths and draw weights. Limb sets are available in three different lengths at two-inch increments. Put the various combinations together and the result is nine different bows with draw weights to 55 pounds in white glass and 70 pounds in olive glass.

The combinations we tested were based on the hunting handle, designated H-16, which is a sand casting, so finely finished that it is hard to believe it is not a die casting like the H-20 and H-24 handles. The H-16 handle has a five-inch sight window cut one-quarter inch past center.

A cutout is provided for broadhead clearance and the shelf slopes forward and downward to afford additional vertical clearance for the broadhead. A quick check showed that a broadhead blade could be drawn to within one-half inch of a vertical line touching the hand pressure point on the grip. This is a very desirable feature for the bowhunter who likes a short hunting shaft for lighter arrow weight. It permits the use of a smaller diameter arrow of reduced stiffness since the weight of the broadhead does not overhang the arrow pressure point by so great a distance. The overdraw is approximately one inch, permitting just enough fore to aft distance on the sight window to mount a Hoyt Pro Flex rest.

Two pre-tapped (1/4"-20) stabilizer mounting inserts are provided on the H-16 handle, one above and one below the centerline. In an interesting and efficient engineering approach, the stainless steel shafts which provide the stabilizer mounting inserts also serve to position (laterally) the inboard or butt ends of the limbs. These shafts bridge the inboard extremities of the limb-mounting sockets in a fore and after direction. The inboard or butt end of the limb is machined to provide a short open slot with a "U" cross section that fits snugly over the shaft with a snap action that accurately positions the limbs for lateral alignment.

Securement of the limbs is at the outboard positioning point where a stainless steel necked-shaft bolt with a 3/4-inch diameter knurled head engages a stainless steel insert in the butt section of the limb from the face side. Consequently, the butt of the limb in the mounted position rests against the socket walls at two positions, at the extreme inboard end on the back and at the outboard end of the mounting pad on the face. Corresponding pressure pads are incorporated in the casting in the socket interior and then pressure-sensitive plastic tape is added to the socket pade to prevent abrasion of the limb finish.

With this design of handle-limb joint, the bending stress of the limb (when the bow is strung and/or drawn) is resisted entirely by pressure against the fore and aft walls of the socket. A short force-couple is created similar to the condition that occurs when we shove the end of a stick into a crack and apply force to the stick to bend it. The retaining bolt serves only to position the limb laterally and to prevent motion in the joint upon recoil action of the limb. It is subjected to very little load over the initial tightening stress.

The stainless steel hardware is finished with a black penetrating coloring to prevent glare. The H-16 handle sports a fine-grained black crackle finish of enamel that is both pleasing to the eye and glare proof.

The limb design is relatively narrow — only 1 1/2 inches at the widest point — with a short taper toward the butt and a gradual rounded taper to a typical slender Hoyt tip and string groove. Olive glass was used on the two matched limb sets we tested and taper-ground laminated "Superflex Actionwood" provided the core.

Each set of limbs employed a different material for the fade-out (heavier wedge of material, usually hardwood, positioned between limb laminations at the butt end of the limb to obtain thickness and strength for mounting; it is sometimes incorporated in the riser) and pad while the other set used resin-impregnated maple or "Superwood." Both materials were pre-colored in a shade of black. This should represent a distinct improvement over untreated hardwood since both of the materials are stronger and more homogenous than the best hardwood and offer the added advantage of high bonding strength when joined with adhesives.

Assembly and disassembly of the limbs and handle was no trick at all — the limb mounting bolts were tightened finger tight.

A 14-strand string was provided with the equipment, reted for draw weights of 45 to 55 pounds — therefore we used it for testing both sets of limbs. After shooting in, we obtained identical brace heights of 9-1/8 inches with both setups — about 1-1/8 inches over the manufacturer's recommended range of 7-1/2 to eight inches. Since string stretching is a

bit of a problem, we let it go at that — the brace height remained at 9-1/8 inches without letdown throughout the tests. This would result in a small loss of stored energy at the beginning of the draw and a corresponding minor reduction in arrow velocity.

A review of our test records indicates that the loss of arrow velocity for the 1-1/8 inches increased brace height might be in the neighborhood of one to 1-1/4 feet per second at the draw weight and arrow mass we are considering. So if you want to add one foot per second to the arrow velocity curves, it wouldn't be too far out of line. On the other hand, it might be considered within the range of experimental error.

THE TESTS

The handle-limb combinations yielded one bow rated 46 pounds at 28 inches draw and one rated 53 pounds at 28 inches draw. The force-draw curves for the two bows are presented in Figures 1 and 2. Note that our draw force scale agreed exactly with the manufacturer's rating for the two sets of limbs.

The force-draw curves show these to be remarkably smooth drawing bows with no perceptible stack through 31 inches of draw. The long-draw archer who wants to shoot a relatively short bow should be very interested in this characteristic.

The values obtained for stored energy and the ratio of stored energy to peak draw force are listed in the accompanying table. All data is for draw lengths of 28 inches. These are good representative values for recurve hunting bows of this type.

Figures 3 and 4 present the arrow velocity and bow efficiency curves for the 46-pound and 53-pound bows respectively. As is our usual procedure, we shot both feather and soft vane fletched shafts. The Pro Medalist T/D launched the vane fletched arrows equally as well as those with feather fletching. This can no doubt be attributed to the past-center window cutout which offers adequate clearance for the vanes.

Observe that the 46-pound limbs yielded the higher values of bow efficiency. This is probably attributable to an increase in glass facing and/or backing thickness for the 53-pound limbs to insure adequate bending strength for the higher draw level. This would increase the total percentage of glass thickness in the limb cross section and account for a somewhat lower bow efficiency for the heavier bow. This is not an uncommon phenomenon as a bowyer adjusts facing, backing and core thickness to obtain varying draw weights.

As noted in the table of test data, we obtained a value of virtual mass of 133.7 grains for the 53-pound bow. (Remember, all other things being equal — such as draw weight, draw length, etc. — the lower the virtual mass the more efficient the bow.)

GENERAL COMMENTARY

We are impressed with the obvious amount of solid constructive and creative thought that went into the design of the Pro Medalist Takedown series. The quality of design, construction and finish in the handle and limb sets we tested was

topflight.

We think that the addition of a laterally adjustable pressure plate or a cushion pflunger to the H-16 handle would be well worth while in obtaining optimum arrow flight for a wider range of arrow spines. It might be advisable to check with the manufacturer to make certain that the window base section has sufficient margin of strength to permit

For all test shooting, the nocking point was set at one-quarter inch above 90 degrees (measured from the bottom of the arrow nock).

Mass weight of the bows varied only one-quarter ounce, with the 46-pound setup weighing in at two pounds, 12 ounces and the 53-pound combination at two pounds, 11-3/4 ounces.

COMPARATIVE TEST DATA

DRAW LENGTH = 28 INCHES

PEAK DRAW FORCE - LB.	46	53
STORED ENERGY FT. LB.	38.59	44.97
S.E./R.D.F.	0.839	0.849
FT. LB./LB.		
VIRTUAL MASS GRAINS	133.7	161.2

Bow assembly and takedown instructions, plus other helpful hints, enclosed in a manual with the bow were complete and easily understood.

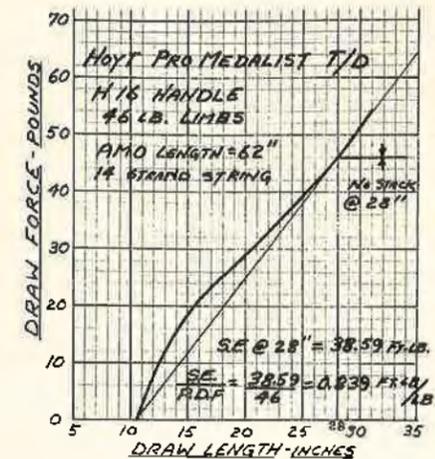


FIG. 1

●The 46-pound bow stores 38.59 foot-pounds of energy at 28 inches, which is 0.839 foot-pounds for every pound of peak draw force.

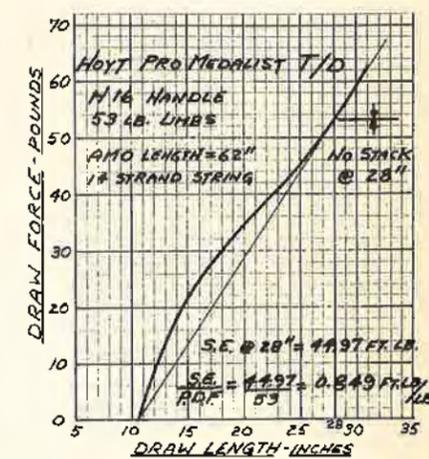


FIG. 2

●The 53-pound bow stores 44.97 foot-pounds of energy at 28 inches, which is 0.849 foot-pounds for every pound of peak draw force.

●Force-draw curves: The area under the curve down to the horizontal base line represents the work necessary to draw the bow. This becomes stored energy. If you would like to roughly check the values given, read the draw force for each inch of draw length, then total these values in pounds from the point where the curve begins (zero intercept) to the stated draw length (28 inches). As example, Fig. 1 shows 21 pounds at 16 inches of draw, almost 24 pounds at 17 inches, etc. Divide the total by 12; this gives you foot-pounds of stored energy. The values on the curves have been calculated by a more accurate, lengthy method of incremental force averaging; you might not come up with the same totals we did, but you should be fairly close.

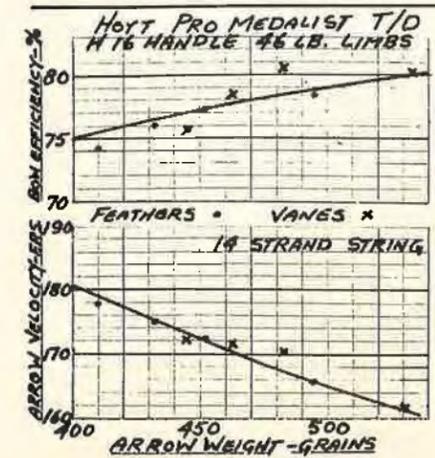


FIG. 3

●Test data showing variation of arrow velocity and bow efficiency with arrow weight. Note, as arrow weight increases, the velocity decreases but the bow efficiency rises in the range of arrows best matched to the bow. This is because the heavier arrows absorb more energy, and less energy is thus dissipated in vibration during the bow's recovery.

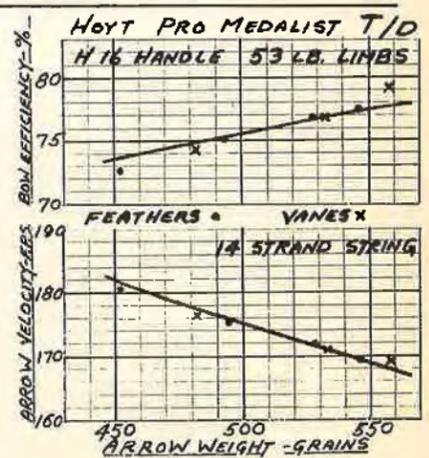


FIG. 4

How and Why Archery World Bow Tests are Conducted

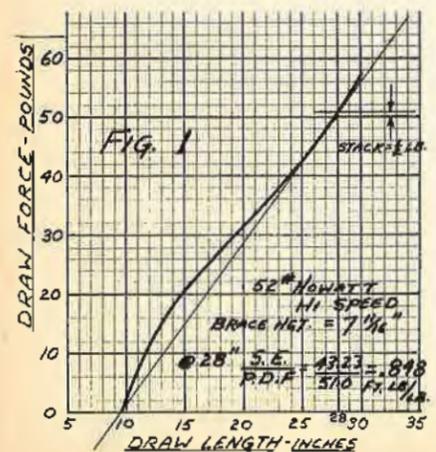
If you read this a bunch of times, there's a good chance you'll understand it. If not, don't worry; you're in company with the editors. However, we've had a lot of requests for the background on how our bow tests are conducted and calculated. We hope this answers those requests. And really, if you sit down with this material and a couple of our printed bow reports, you'll catch on. If you have the equipment to run your own tests, this information will be invaluable.

by **Norb Mullaney**

BOW TESTS have been performed for many years; they have ranged in quality from very bad to very good. Underlying all of this testing is a basic desire of archers to know certain things about the bow that are not readily apparent from casual shooting.

First, we want to know how much energy a bow stores when it is drawn and how efficiently it stores this energy. To measure this efficiency we should relate the energy stored to the maximum force that we must put forth when drawing the bow. After all, we have a limit as to the pull that we can exert and we want to shoot a bow we can handle. Within the limits of the pull we can muster, we'd like to store the greatest amount of energy possible.

To determine the total energy that is exerted (and stored) when the bow is drawn, we measure in one-inch intervals the force necessary to pull the string from brace height position to full draw. This information, when plotted in chart form, gives the force-draw curve for the bow. (See Archery World, October/November 1974 issue — "What We Can Learn From A Force-Draw Curve.")



For comparative bow tests we standardize all data by using the AMO standard 28-inch draw length as the value for testing. Consequently, the area under the force-draw curve represents the inch-pounds of energy that were required to draw the bow. This is the potential or stored energy that is available to restore the bow and propel the arrow when the string is released.

We calculate the stored energy by computing an average value of force for each one-inch segment of the force-draw curve and then adding all of the average values to obtain the area under the curve. Refer to Figure 2.

BRACE HGT - 7 1/16 BOW	INCHES	AVG. FORCE	INCH-POUNDS
6			
7			
8			
9 1/16 = 0		0.99	4.5
10	2.0	4.5	9.0
11	3.0	9.25	27.75
12	4.0	13.25	53.0
13	5.0	16.5	79.5
14	6.0	19.38	106.72
15	7.0	21.88	134.75
16	8.0	24.12	163.5
17	9.0	26.25	193.0
18	10.0	28.38	223.2
19	11.0	30.5	254.0
20	12.0	32.63	285.6
21	13.0	34.75	318.0
22	14.0	36.88	351.12
23	15.0	39.0	385.0
24	16.0	41.25	419.7
25	17.0	43.5	455.25
26	18.0	45.75	491.5
27	19.0	48.0	528.5
28	20.0	49.5	566.25
29	21.0		
30	22.0		
31	23.0		
32	24.0		

It is more usual and convenient to express the stored energy in foot-pounds rather than inch-pounds, so we divide by 12 to convert:

$$\frac{518.72 \text{ in.-lbs.}}{12} = 43.23 \text{ ft.-lbs.}$$

(Result is rounded to two decimal places.) Thus, when the bow is drawn to 28 inches it has stored 43.23 ft.-lbs. of energy. We will call this value stored energy (E_s).

Since this is a conventional recurve bow, not a compound, the highest draw force obtained (peak draw force) was measured at the highest draw length (28 inches). When selecting a bow, we are interested in obtaining the maximum stored energy possible for a given peak draw force; we would like to have a measure of how efficiently the bow stores energy for comparative purposes. This measure of energy storing efficiency is obtained in terms of foot-pounds of stored energy per pound of peak draw force. It is calculated by dividing the stored energy by the peak draw force:

$$\text{Stored Energy} = \frac{43.23 \text{ ft.-lbs.}}{51 \text{ lbs.}} = 0.848 \text{ ft.-lbs./lb.}$$

At this point the static evaluation of the bow is complete. We may make adjustments to the bow or setup such as changing brace height or, on a compound, varying one or more of the many adjustable settings and then repeat the foregoing procedure. This is an excellent method of fine tuning a bow for optimum performance, or to obtain specific desirable characteristics to suit a personal requirement.

We have added one further element for compound bows and that is a determination of the static hysteresis for the system. As in any mechanism (and the bow is a mechanism) there is energy loss to friction within the system even in the simple bending and relaxing of the limbs. Under the dynamic conditions of a shot, energy is lost within the bow to friction and to air resistance, sound, heat and recoil. Some of these energy losses are very small, interrelated and quite complex, but they occur nevertheless.

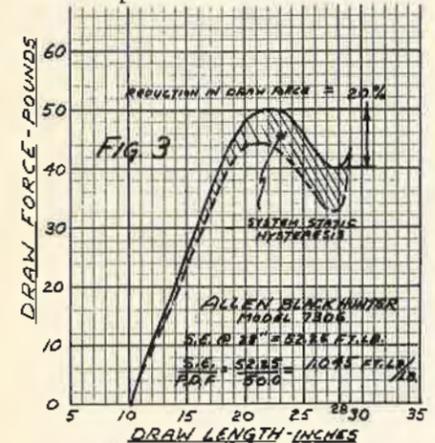
(For straight or recurved composite bows using modern materials and construction, exceptionally sensitive laboratory-type measuring equipment is required to register static hysteresis, and for practical purposes can be neglected.)

Hysteresis is the term applied to the energy lost in the system and hence not recoverable. It can be readily visualized in the following manner.

When a weighing scale is fastened to the bow string and the draw-force is measured and recorded for each one-inch increment as the string is moved from brace height to full draw, the resulting plot is the force-draw curve. If, as the bow is relaxed from full draw, new measurements of force are made at each one-inch position as the draw is relaxed from full draw to brace height, lower force values will be obtained at each position. On self-bows (only one material used in construction — all wood, all fiberglass) the difference is readily discernable; however, on modern composite bows, the commercial type weighing scales normally used are not sensitive enough to read the difference. Assuming that the difference is sufficiently finite to be plotted on the force-draw curve, there will be a lower curve for the relaxing condition and a loop will be formed. This is known as a hysteresis loop. The area within the loop is the hysteresis loss to the system or mechanism.

Now if we consider a compound bow

with its eccentrics, idlers, cables and hangers, the loss of energy to friction within the system is very significant. The force-draw curve and hysteresis loop for a typical compound bow are shown in Fig. 3. Note that the difference in the force values at the peak of the curve is about six pounds.



The term static hysteresis is used to denote this energy loss because the system is at rest when each measurement is made. In this manner the frictional forces are due to static friction. Friction of motion or kinetic friction under these conditions is generally less than static friction. Hence, if it were possible to measure the hysteresis while the bow was being shot, the hysteresis loop or loss would be substantially smaller.

Static hysteresis is only valuable as a characteristic for comparison between bows. Since it does not exist as measured under the dynamic conditions of shooting, it must be viewed in proper perspective. It is logical from an engineering standpoint to assume that the bow with the highest static hysteresis will also have the highest kinetic energy, all other conditions being equal.

The energy lost to static hysteresis may be calculated by computing the area under the relaxing curve of the force-draw diagram (the section that forms the bottom side of the hysteresis loop) and subtracting this value from the stored energy. This gives the foot-pounds of energy within the loop and is the summation of system static hysteresis. It will be interesting to attempt to relate static hysteresis to bow efficiency as sufficient data becomes available to permit trend analysis.

The second, and probably the most important, characteristic we want to evaluate in a bow is shooting performance. A bow can store energy quite efficiently and yet not deliver an arrow very well.

Not all of the energy stored in the drawn bow is imparted to the arrow when the shot is made. Some percentage of the stored energy is lost in the process of shooting the bow. It is dissipated in the recovery of the limbs and string,

there is minor loss to air resistance, heat and sound and also energy absorbed in recoil.

In a compound bow a significant amount of energy is consumed by friction in the eccentrics, idlers and cables of the compounding system. In addition, energy is required to overcome the translational and/or rotational inertia of the eccentrics, idlers and associated hardware required for the system.

We know, therefore, that the energy possessed by the moving arrow as it leaves the bow is some fraction of the total energy that we stored in the limbs when drawing the bow.

The laws of physics give the familiar formula for the kinetic energy (energy of motion) of a moving body at any instant.

$$\text{kinetic energy} = E_k = \frac{1}{2}mv^2$$

where m = the mass of the body in slugs
 V = the velocity of the body in feet per second
 kinetic energy is in foot-pounds.

For those not familiar with the term "slug," it is the British absolute engineering unit of mass and is obtained by dividing the weight (in pounds) by the acceleration of gravity (32.2 ft/sec²). Since the weight of an arrow is usually obtained in grains (1 lb. = 7000 grains), by substitution we can express the formula for the kinetic energy of the arrow in a more convenient form:

$$\text{Formula 2) } E_k(\text{ft.-lb.}) = \frac{W_a V^2}{450800}$$

where W_a = weight of the arrow in grains
 V = arrow velocity in feet per second

PROBLEM: OBTAINING VELOCITY

We are all familiar with methods of weighing arrows on commercially available scales that read in grains. There remains the problem of obtaining the velocity of the arrow as it leaves the bow. This can be accomplished in a number of ways, but the modern approach is through the use of an electronic timer or chronograph in conjunction with a pair of trigger circuits. The trigger circuits, one to start the timer and one to stop the timer, are set with a predetermined distance between them so the arrow may be timed over a fixed distance.

The Kaufman chronograph we use has a 100,000 Hertz (cycles per second) oscillator with an octal readout. A chart is provided that converts the octal readout to velocity in feet per second. Two types of trigger circuits are provided: 1) a conductive grid printed on paper strips which triggers the timer when the arrow breaks the grid circuit; 2) a photoelectric circuit which is actuated when the arrow interrupts a beam of light. We prefer the photoelectric method because it can be reset with the touch of a button and creates

no debris.

Knowing the arrow weight and velocity, it is a simple matter to compute the kinetic energy of the arrow using Formula 2.

$$E_k = \frac{W_a V^2}{450800}$$

$$E_k = \frac{484.75 \times (173.45)^2}{450800}$$

$$E_k = 32.35 \text{ ft.-lbs.}$$

$$W_a = 484.75 \text{ grains}$$

$$V = 173.45 \text{ feet per second}$$

OVERALL EFFICIENCY DEFINED

While the kinetic energy of the arrow is an interesting value in itself, its principal use is in the computation of the overall efficiency of the bow.

The overall efficiency of the bow is defined as the ratio of the kinetic energy of the arrow as it leaves the bow to the energy used to draw the bow, expressed as a percentage. Since we have employed the term stored energy to represent the energy necessary to draw the bow (represented by the area under the force-draw curve) we may write:

$$3) \text{ Bow Efficiency} = \frac{E_k(\text{arrow})}{E_s(\text{bow})} \times 100$$

This formula may be rewritten as:

$$E_k(\text{arrow}) = E_s(\text{bow}) \times \text{Efficiency \%}$$

Substituting in Formula 2, we have:

$$\text{Formula 4) } E_s(\text{bow}) \times \text{Efficiency \%} = \frac{W_a V^2}{450800}$$

with all values as represented in prior definitions. Sample:

$$\text{Efficiency} = \frac{E_k}{E_s} \times 100$$

$$\text{Efficiency} = \frac{32.35}{43.23} \times 100$$

$$\text{Efficiency} = 74.8 \%$$

$$E_k = 32.35 \text{ ft.-lbs.}$$

$$E_s = 43.23 \text{ ft.-lbs.}$$

It is not too difficult to reason, and it is readily apparent when shooting a bow, that a given bow at a given draw length will not shoot heavy arrows as fast as it will shoot light arrows. But one fact that is not normally considered is that the same bow will impart more energy to the heavier arrow than it will to the light arrow.

This occurs because the bow delivers a greater percentage of the available stored energy to the heavier arrow, thus less energy is left to be dissipated in the bow. Most archers can sense that a bow is quieter and offers less recoil as arrow weight is increased — so no matter how insensitive bow hand and ear are, you can readily tell the difference by the jarring in your hand and the overall noise (not string slap).

Utilizing actual chronograph test data
 (continued on page 68)



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●Above, from left, McKinney, second; Pace, first; and Laasonen, third in the men's division. Photo by Ann Hoyt.

●Above right photo, U.S. team members in their spirit-building huddle before shooting. Photo by Grace Kremer.

●At right, from left, Kovpan, second; Rustamova, first; Sun, third in women's division. Photo by Ann Hoyt.

●Below, U.S. team members and officials marching onto the field for opening ceremonies. Photo by Ann Hoyt.



The honor and the tension

World archery competition is a special scene all to itself. You won't feel it until you've been there.

TWO YEARS AGO, the United States women's team placed all four team members on the Top-10 board and Linda Myers won the individual title, with a second in women's team scoring. This year, the U.S. men turned it around. They placed all four guys in the top six, and Darrell Pace won the men's individual title. They also won the Men's World Archery Championship team title at Interlaken, Switzerland.

But before reciting the records set by archers in women's and men's divisions, consider the work, dedication, tension and psychological preparedness of each individual archer necessary to get them there. This is world competition! Sure, there may be tournaments here and there with slightly tougher shooting, but there's nothing like this when it comes to representing yourself and your country in front of the world.

It gives you the shakes just to think about it.

Then when you get there, the pageantry and solemnity of it all begins to unfold. The pace is deliberate. Protocol is followed. By the time you've gone through the opening parade and ceremonies, you're tighter than any bow-

string ever thought of being.

And now they expect you to shoot arrows? And hit gold?

As team captain Harold Kremer said, "It's a different type of competition, frightening at first. But our team got over it and shot well. I'm really proud of them."

Irene Lorensen, who finished sixth, right behind Linda Myers, said she was very nervous all four days. "I think you have to shoot in one before you can expect to win one. You're representing your country, not just yourself. But the burden, and honor, is on your shoulders. You're trying too hard to do your best at first and nothing comes out smooth. So you fall back on simply going out there, doing the best you can and trying to improve your shooting form all the time."

Kremer noted that tension and small equipment problems kept team totals from being higher. "Ruth Rowe had trouble with an arrow rest the first day and was in seventy-second place, but she made a tremendous recovery the next three days to finish in fifteenth place. Irene threw five arrows off the target, and she never does that. Doug (Brothers, who placed sixth) would have done better except for a broken string the last day."

Rich McKinney, who finished second to Darrell Pace, said, "Doug and I worked for years to get there. Suddenly we're there and it dawns on you. Then you get the shakes. For instance, I was starting to make a move with a 46 and an arrow to go on the last 70-meter target. My next shot missed the target. That was the last arrow of that day. I did the same thing with the first arrow at 50 meters the next day . . . there was some mental carryover . . . and that blew my concentration for a while."

Linda Myers, though she was defending champion, said she shot better than she expected. "I've been doing only archery since 1972. There's been no time to do anything else. I want to shoot, but there are a lot of other things to life, too."

"My form has been rough, mainly in my release. I come back and it feels good, but I can't pull through the clicker. When you know that everyone is pointing toward beating you, that makes it tougher."

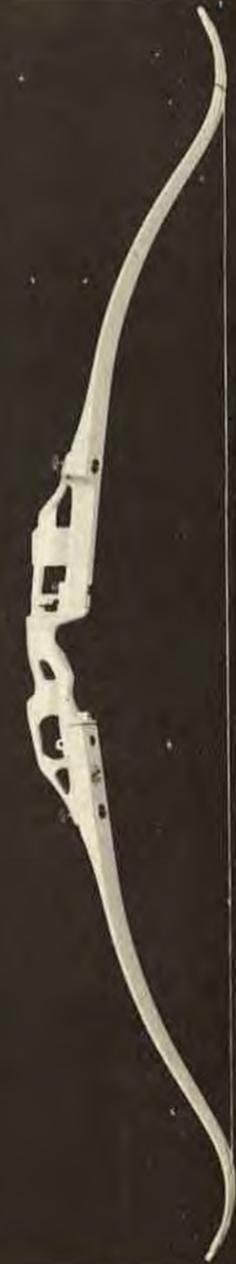
Team members noted that some of the other countries are exercising to such a point that they do calisthenics or stretching exercises between ends. A couple of teams have a bow handle fitted with rubber tubing so they can practice drawing behind the line. (No competitor is allowed to draw an actual bow except on the shooting line.)

Weather was basically decent. The last day had threatening skies until the last arrows for the last shooting line and then it poured. But the rain was too late

(continued on page 74)

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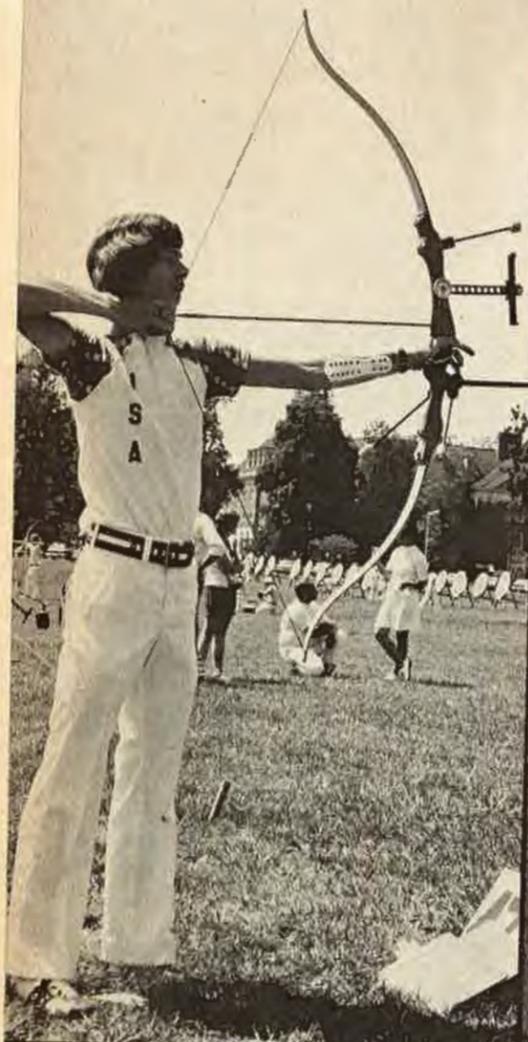
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NAA NATIONALS...

The first 1300 FITA

Darrell Pace's 1316, and Irene Lorensen's 1242, head a list of record scores aimed at next year's Olympics



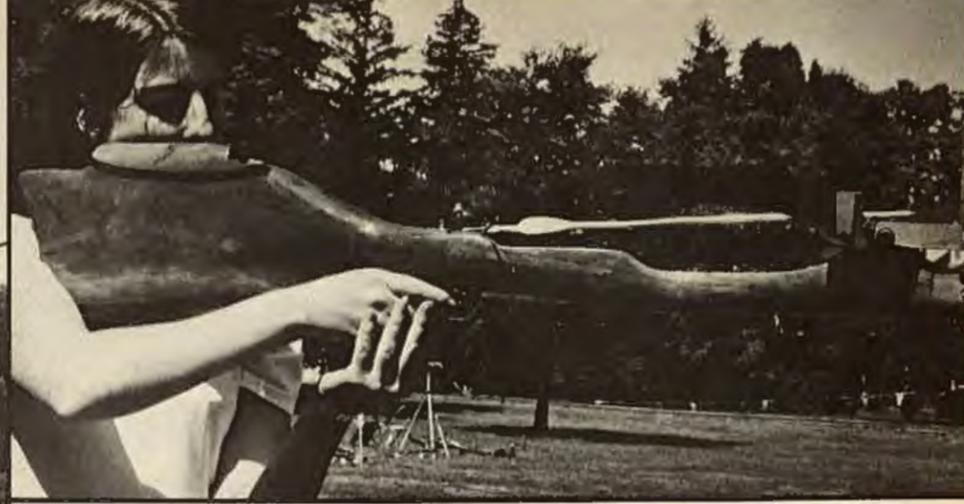
•Darrell Pace, three-time NAA men's champion and the first person ever to shoot a sanctioned 1300 FITA. He scored a 1316 at the 1975 Nationals.



•All the first through third place winners in every division at the 1975 NAA Nationals pose for photographers at Oxford, Ohio.



•Irene Lorensen, women's amateur champion and holder of women's world FITA record with 1256, shot 1242 in dethroning four-time champ Doreen Wilber.



•Carol Pelosi, perennial women's crossbow champion, shooting a new style of crossbow, the Ward bow. She won again with a 3034 total. Richard Lambert was men's titlist.



•Darrell Pace, 1975 world target champion, and O. K. Smathers, 1957 champion: the youngest and oldest world champions on the line at Oxford.

•This archery business isn't all that serious. Sometimes you even want to sit down, rest and let someone else pull your arrows.

THERE'S NOT MUCH you can say, other than "wow!" in looking at the results of the 91st National Target Archery Championships at Oxford, Ohio, in early August.

Item: Darrell Pace set an NAA and world record by shooting a 1316 FITA — the first registered 1300 score ever shot. That's an effort best equated with the breaking of the four-minute mile.

Item: Irene Lorensen set an NAA record with her 1242 FITA, which was only 14 points shy of the world record 1256 she shot in New York a few weeks earlier.

Item: The top seven amateur men shot 1200 or better; the top nine amateur women shot 1100 or better.

Item: The four top intermediate boys and the three top intermediate girls shot 1100 or better, with Sandi Van Kilsdonk's 1187 and Richard Bednar's 1211

highlighting this group. Miss Van Kilsdonk's total of 2781 was good for second place on the women's board, and Bednar's 2894 was good for fourth on the men's. The kids are coming on!

So, in the last major competition for most archers before the Olympic tryouts next summer, United States archers have given indication that their presence will be felt.

So have the Canadians, who were here in force. They put three women and two men on the board. They, like many topflight U.S. archers, have been on the go almost constantly this summer, and they're tired. Ron Lippert, for example, said he's been home one and a half weeks since early May. But with everyone pointing toward the Olympics, the tiredness is something to be ignored as much as possible.

Darrell Pace, who now freely admits

he's shooting for records every time he's on the line, was more than pleased with his 1316. "I've shot a few points better in practice, but this one counts," he said, and smiled.

He now has 17 of the 20 world and world-tournament records. He's missing the 70-meter double, 70-meter world-tournament double and 70-meter world-tournament single marks.

Pace, who hasn't really had a slump for three years, obviously understands the intricacies of his form quite well. This, he feels, is the key because "bad form setup is just cheating yourself."

He does all his FITA testing and practicing at 90 meters. "You can't get away with clutched shots or tuning problems at that distance," he explains.

It paid off, in the respect that his 70-meter score of 333 was 11 points above any score he's ever recorded on that dis-

tance, even in practice. "Al Muller helped me. He was shooting right next to me and kept pushing and prodding me and telling me I could do at least 332. Then it got to where I wanted to beat his prediction."

Pace had only one arrow in the blue, a 90-meter shot. This was the first time he's ever done that.

The only prediction Pace makes is that the 1316 tally will be broken within two years, maybe sooner, and that Irene Lorensen will be the woman to break 1300. "She's really strong and has a confident belief in herself. That will pay off," he says.

Rich McKinney, who finished second to Darrell again, said, "That 1300 is going to see a rush of high 1200's and then some 1300's. It's all mental. Like with Irene . . . she knows the 1250 is no big barrier anymore since she shot that

1256 in New York.

"Heck, can anyone remember who shot the first 1200? I asked Gene Moore; he didn't even know. And he's been around longer than anyone."

With that statement, McKinney looked around to see if Moore had overheard. Unfortunately, he hadn't, because it was a good needle.

Irene Lorensen, the new women's titlist, said the first three months of this year she was shooting in the low 1100's. She was also getting a bit disgusted with her scores. Then during a practice session — she shoots four hours a day — she noticed that the vanes on her arrows were positioned too far back. She was hitting the vanes with her fingers on release and that was throwing the arrows off.

With that corrected, and constant practice on shooting form, she's been

shooting regularly in the 1240's and 1250's. She works most on her bow arm and shoulder. "I can't lock them like I should, so the arm starts coming up."

Her release is the best part of her shooting form, she says. She puts the tip of the arrow on the clicker and then finishes the draw with a slight pull from the bottom finger. This pulls the arrow through the clicker.

Irene's strength that will help her shoot a 1300 someday? Well, in practice with Steve Lieberman shortly after the world tournament, she shot a 1236. On the men's distances!

At the New York shoot where she set the total score world record of 1256, she also set a world record at 30 meters with a 344.

There were quite a few Kevlar strings being used, some with complete confi-

(Continued on page 75)

National Archery Association of the United States
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HENDERSON, HELWIG NAMED OLYMPIC TEAM COACH, MANAGER

Al Henderson, Phoenix, Arizona, and George Helwig, Cincinnati, Ohio, have been named coach and team manager, respectively, of the 1976 United States Olympic Archery Team. Helwig is president of the National Archery Association and was the team manager for the 1972 U.S. Olympic team. He also is chairman of the U.S. Junior Olympic Archery Development program.

Henderson owns and operates an archery lane/pro shop business. He has been actively coaching archers since 1947, and has played a large part, with high school and college coaches in his area, in the development of Arizona archery.

"This is the highlight of my coaching career," he said. "The job, as I see it, will be to help build and maintain team members' confidence, help build a team spirit, fight for the archers when they need help, work for them to keep their shooting smooth."

"I'll be working with them to learn their individual shooting styles and forms so I can detect any changes or variations in their form. They will be champions already; at the final stages it will mainly be fine honing. People on the team have set patterns in shooting, training, life style . . . everything. They will be intense, finely tuned — just like their equipment — and big changes could jar them out of adjustment."

"It will be one heck of a responsibility to gain their confidence. It's going to be fascinating, and the greatest challenge and honor I ever hope to have."

"Like the shooters, I'll be representing my country. I've never had that chance before," Henderson said.

The new coach has coached state, regional, national and world competitors. Main thrust of his coaching is positive attitude. "I see too many people trying too hard. Shooting can't be forced. You have to put your form and yourself together and let it happen. Trying too hard unbalances everything. Your muscles tense, your head comes unglued. So you try to force a correction instead of gently moving it through a suggestion. A lot of it is psychology. You have to remember that you should know yourself and your equipment — and how they work together — as well as possible. So if you're shooting good, let it happen. And if you're shooting lousy, relax; you can't shoot any worse. Just start putting it back together."



U.S. Olympic Archery Team manager George Helwig (left) and coach Al Henderson.

MAJOR TOURNAMENTS TOP 1976 CALENDAR

The U.S. Indoor Archery Championships, April 3, at Harrisburg, Pa., top the 1976 NAA tournament calendar to date. Other major events are:

- U.S. Olympic Team Tryouts, June 16-19, Oxford, Ohio;
- Montreal Olympic Games archery competition, July 27-30;
- 92nd U.S. Archery Championships, August 4-7, Valley Forge, Pa.;
- 4th World Field Archery Championships, September 4-5, Sweden

NAA is interested in preparing a full calendar of tournaments for 1976 and asks that dates be set as early as possible, and forwarded to the NAA secretary.

●Near right, Bob Rhode watches Bruce Odle set national and world unlimited records in NAA National Flight Championships. Center, Vernon Godsey fires 80-pound bow and arrow he designed and built. Far right, Jim Pickering watches Myrna Ambler's compound release in new broadhead class.



1975 NAA FLIGHT CHAMPIONSHIPS

Near perfect conditions at the NAA Flight Championships, held at Wendover, Utah, August 2nd and 3rd, helped in establishing a new world and national flight record, along with four other national flight records.

Shooting in the amateur division, Bruce Odle, from Clearfield, Utah, became the first man in modern history to shoot an arrow over 900 yards from a hand held bow. Odle's 922 yd., 1 ft., 4 in. distance, shot from a 108-pound bow, exceeded Harry Drake's 1967 record of 856 yds., 1 ft., 8 ins. by 65 yds., 2 ft., 8 ins. Harry Drake did not shoot at the 1975 Nationals, but concentrated his efforts toward making Odle's equipment and coaching him in his shooting. Drake seemed just as pleased with the new world record as Odle was, even though Drake's record had been broken. Bruce's record shot also replaces Danny LaMore's 850.67 yards as the amateur men's unlimited record.

Kelly Reynolds, from Salt Lake City, Utah, set a new intermediate boys record in the unlimited class with his 667-2-5 shot from a 50-pound bow. This was the second longest 50-pound distance of the tournament. Kelly missed breaking the existing 50-pound record for intermediate boys by less than a yard prior to setting his unlimited record.

Myrna Ambler, from Salt Lake City, worked for almost a year at handling the 50-pound bow and reached her goal at the nationals by setting a new 50-pound record for amateur women. Her 649-0-10 effort also exceeds the non-amateur women's 50-pound record.

Amateur Vernon Godsey, of S.E. Renton, Washington, broke the 80-pound record with his 779-1-4 shot and Ike Hancock, of Salt Lake City, set a 65-pound amateur men's record with 749-1-2. Harry Drake still holds all but the 50-pound record in the non-amateur men's division which includes his incredible unlimited footbow record of 2028 yards.

Of interest, in winning the unlimited non-amateur class, Arlan Reynolds, from Salt Lake City, used an 80-pound stock limb long bow (Browning Cam-Loc) equipped with a taped-on overdraw to shoot a 25-inch flight arrow 744-2-5. It is doubtful

that anyone has ever equalled this performance using such a comparatively light bow of this length.

The broadhead flight tournament for compound and conventional bows produced new records which will be sought after at future events. These limited 80-pound classes are very competitive and are a real test for the hunting bow. The 1976 NAA Flight Championships should produce new records in these classes. Bruce Odle's 405-2-10 broadhead shot for the compound and his 416-0-6 conventional broadhead shot has been exceeded by several persons in practice.

Reynolds' surprising 720-0-2 compound bow regular flight win for the unlimited non-amateur class was shot with a standard 80-pound compound (Browning Stalker), set up with an overdraw. Arlan shot the same 25-inch wood flight arrows that he used to win the unlimited non-amateur regular flight event.

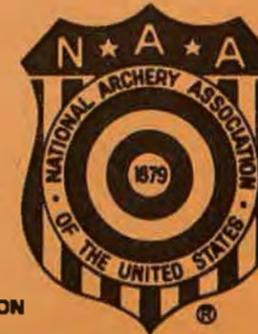
Flight winners: Amateur men, 50-pound class, Ike Hancock, 675 yards, 0 feet, 9 inches; 65-pound class, Ike Hancock, 749-1-2; 80-pound class, Vernon Godsey, 776-1-4; unlimited class, Bruce Odle, 922-1-4. Amateur women: 35-pound class, Myrna Ambler, 527-1-0, 50-pound class, Myrna Ambler, 649-0-10; unlimited class, Myrna Ambler, 631-0-1. Non-amateur men: 80-pound class, Arlan Reynolds, 627-0-6; unlimited class, Arlan Reynolds, 744-2-5. Intermediate boys: 50-pound class, Kelly Reynolds, 646-1-10; unlimited class, Kelly Reynolds, 667-2-5. Junior boys: 50-pound class, Bob Ambler, 311-0-6; unlimited class, Bob Ambler, 213-2-3.

Westcott medals: Men, Bruce Odle, 922-1-4; Vernon Godsey, 831-1-4; Ike Hancock, 765-0-4. Women, Myrna Ambler, 649-0-10; Frances Lederer, 448-1-5.

Eighty-pound compound bow broadhead flight, amateur men, Bruce Odle, 405-2-10; non-amateur men, Arlan Reynolds, 399-2-4; amateur women, Myrna Ambler, 193-0-9. Eighty-pound conventional bow broadhead flight, amateur men, Bruce Odle, 416-0-6; non-amateur men, Arlan Reynolds, 398-1-4; amateur women, Myrna Ambler, 239-2-8. Unlimited compound bow regular flight, non-amateur men, Arlan Reynolds, 720-0-2; amateur women, Myrna Ambler, 351-2-11.

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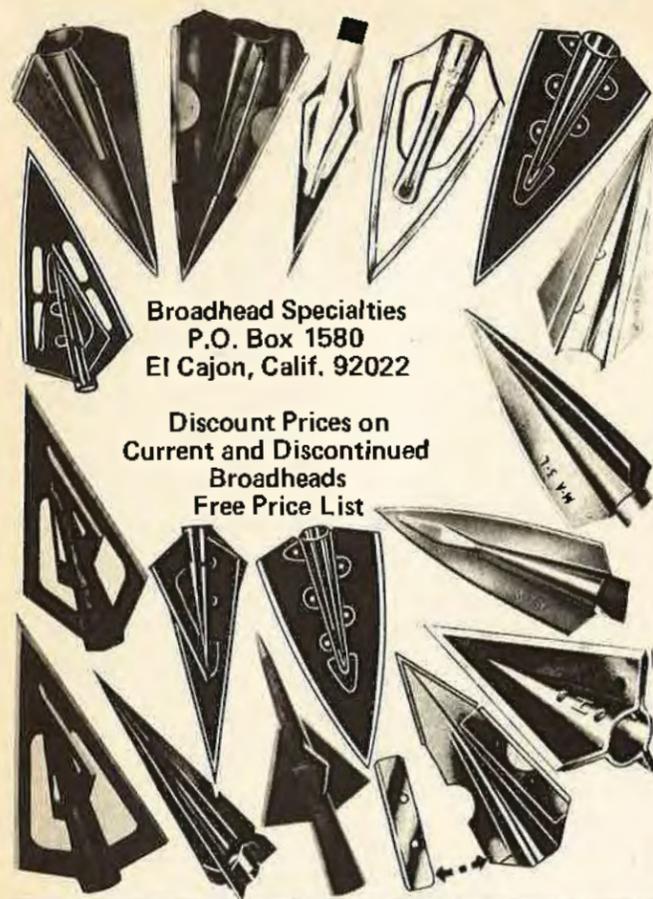


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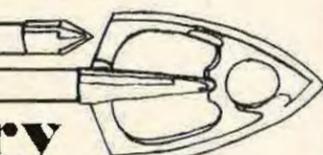
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LORENSEN SETS WOMENS WORLD RECORD AT NEW YORK CHAMPIONSHIP

Irene Lorensen, of Phoenix, Ariz., set a new womens world record in the FITA round at the recent 44th Annual New York State Archery Championship at Greene, N.Y. Her score of 1256 will be given international recognition, subject to FITA approval. Lorensen also shot a record score for the 30-meter part of the round.

Other New York champions include: womens 1975 champion, Jeanette Nelson, Greene, 1793; 2nd place, Sharon Simmonds, Greene, 1724; 3rd place, Cathi Towner, Auburn, 1692; Class A 1st place, Jean Raymond, Greene, 1643; 2nd place, Beth Flannery, Greene, 1469; 3rd place, Linda Magratten, Yonkers, 1231; Class C 1st place, Dr. Alice Hilton, Dunkirk, 1183; 2nd place, Jeanne Gibson, Greene, 1183; 3rd place, Mary Wheeler, Floral Park, 973. Womens out-of-state champion was Irene Lorensen, 2103; 2nd place, Linda Myers, York, Penn., 2054; 3rd place, Ruth Rowe, Mt. Lebanon, Penn., 1988.

Mens champions include 1975 champion David Hryn, West Seneca, 1980; 2nd place, Philip Hoelle, Smithtown, 1846; 3rd place, Pierre Berthelon, Brooklyn, 1802; 4th place, Monserrate Roca, Yonkers, 1801; 5th place, Greg Bigelow, Syracuse, 1800; Barebow and Class A 1st place, Robert Christensen, East Patchogue, 1673; 2nd place, Frank Baumgart, East Meadow, 1638; 3rd place, Raymond Wheeler, Floral Park, 1555; Class C 1st place, Stan Lukaszewicz, Blasdell, 1310. First place professional man was Robert Wallace, Brooklyn, 1346; 1st place out-of-state man, Arne Jacobsen, Denmark, 2057; 2nd place, Stephen Lieberman, Reading, Penn., 2030; 3rd place, Bruce Affrunti, Waterford, N.J., 1995.

Intermediate boy champion was Brian McGuirl, Chenango Forks, 1770; 2nd place, Mitch Weseley, Great Neck, 1668; 3rd place, John Wheeler, Floral Park, 1670. Junior boy champion was Ronald Bergum, Angola, 1790; 2nd place, Shaun Detweiler, Greene, 1692; 3rd place, Bruce Kryszak, Angola, 1515. Cadet boy champion was Brian Bergum, Angola, 1659; 2nd place, James Wheeler, Floral Park, 1585; 3rd place, Glen Kryszak, Angola, 1539; First place intermediate out-of-state boy was John F. Gruitt, East Stroudsburg, Penn., 1706; First place out-of-state junior boy was Tony Murawski, Jr., Westfield, N.J., 1668.

Intermediate girl champion was Lanette Simmonds, Greene, 1731; 2nd place, Lauren Lake, Greene, 1350; 3rd place, Gail Bromley, Greene, 1349; Junior girl champion was Jean Marie Delaney, Greene, 1467.

U.S. FIELD ARCHERY CHAMPIONSHIPS

Here's how it went at the U.S. Field Archery Championships held July 12-13 at Hemlock Field Archers range, Lebanon, Pa.

In men's freestyle, Richard McKinney, Muncie, Ind., topped them all with a 550 Hunter, 548 Field good for a 1098 total. (Hunter distances were unmarked.) Ruth Wallace, Elizabethtown, Pa., won women's freestyle with 462-505/967. Frank Ditzler, Lebanon, Pa., won men's barebow with 488-430/918. Eunice Schewe, Roscoe, Ill., won women's barebow with 390-403/793. Tony Reamer, Carlisle, Pa., won intermediate boy's with 509-506/1015.

Following McKinney were Larry Smith, Glenrock, Pa., 545-530/1075, and Jeff Painter, Reading, Pa., 528-544/1072. Following Wallace were Winnie Eicher, Altoona, Pa., 447-416/863, and Martha Smith, Glenrock, Pa., 436-408/844. Trailing Ditzler were Robert Hoke, Lebanon, Pa., 441-379/820, and Larry Ream, Lebanon, Pa., 414-377/791. Following Schewe were Nedel Moritz, Cleona, Pa., 384-343/727, and Rebecca Wallace, Michigan, 308-336/644. After Reamer were David Mesloh, Harrisburg, Pa., 484-448/932, and Chuck Brawner, Indiana, 448-458/904.

FIELD CHAMPIONSHIP OF THE AMERICAS

The Second Field Championship of the Americas will be held Nov. 15-16, in central Florida, at Gainesville. All of the FITA-member nations of North America, Central America,

South America and the islands of the western hemisphere are eligible to enter. Competition will be in men and women freestyle, and men and women barebow. The U.S. will field a team of eight, two archers in each bracket.

Tryouts will be held Oct. 11-12 at the Hemlock Field Archers Range, Lebanon, Pa. To participate, you must have posted a qualifying score by Sept. 21. Qualifying scores are: men freestyle, 450; men barebow, 400; women freestyle, 400; women barebow 350.

If you are eligible, contact the NAA, 1951 Geraldson Dr., Lancaster, Pa. 17601 for full information and an application. **FITA RULE CHANGES**

The International Archery Federation (FITA), at their meeting June 30, certified Article 226(d) which reads: "Archers forfeit eligibility if participating in international archery championships, games or international tournaments other than specified above and therefore are not recognized, controlled or directed by FITA or a member association of the International Archery Federation and International Olympic Committee."

This applies to participation in international events only, and has no bearing on national competition. The ruling became effective July 1, 1975.

FITA also verified Article 227(f), which reads: "Information as to the type of personal technical equipment archers use may not be provided for intended publication or advertisement." This also became effective July 1, 1975.

There were no changes in FITA target shooting rules. The only changes made in field rules, which takes effect January 1, 1976, state: "Serving on the string must not end with the archer's vision at full draw. Each arrow shall be numbered by the use of plainly visible rings approximately five millimeters in width and with five millimeters spacing. Field glasses may be used within shots in the freestyle class. The archer's draw position and relationship of the arrow to drawing fingers must not change."

BOARD MEMBERS ELECTED

At the NAA membership meeting in Oxford, Ohio, Aug. 7, George Hoffmeister, Hastings, Nebraska, and Harold Kremer, Rydal, Pa., were reelected to the NAA Board of Governors, representing the central and eastern regions, respectively. Karl Radde, Diamond Bar, California, was elected as the western region governor, replacing Donald Nist, Pasadena, Cal. All three were elected for three-year terms.

NAA BOARD ACTION

The NAA Board of Governors has made a change in Article 600 (eligibility and classifications) from the official NAA tournament rules. They deleted "however, an archer whose birthday occurs after March 31 in the year of his/her 12th, 15th, 18th birthday shall be permitted to compete in the lower age group until Oct. 1 of the same year." With those words removed, it now means that an archer must shoot in the highest age class if the official start of the tournament shall be on or after the birthday which places him/her in the higher age class.

OHIO ARCHERS TARGET CHAMPIONSHIPS

The Ohio Archers held their amateur target championship July 12-13, and here are the winners: Rodney Baston, freestyle AA champion, 1227 FITA and 867 "900" Round, 2094 total; Rick Bednar, second with 1170-850/2020; Gary Smyth, third, with 1174-818/1992; Jim Cook, freestyle A, 963-742/1705; Ed Shinkle, barebow A, 750-628/1378; Richard Smith, intermediate boys, 1136-813/1949; William Blaze, junior boys, 1248-840/2088; Georgia Seabolt, women state champion, 818-690/1508; Rick Wray, 1090-826/1916, and Betty Riggleman, 970-747/1717, visitors champs.

PACIFIC COAST CHAMPIONSHIPS, OCT. 25-26

The Third Annual Pacific Coast Championships will be held at the Frontier Archery Lanes, Sacramento, Cal., on October 25 and 26. The event, sponsored by the State Archers of California, will include a Registered STAR FITA Saturday and an NAA 900 Round on Sunday. Contact: Karl Radde, 445 S. Del Sol Lane, Diamond Bar, Cal. 91765, 714/595-9388.

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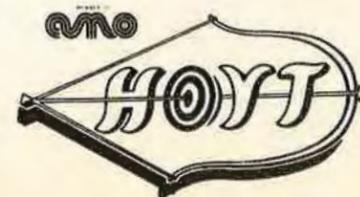


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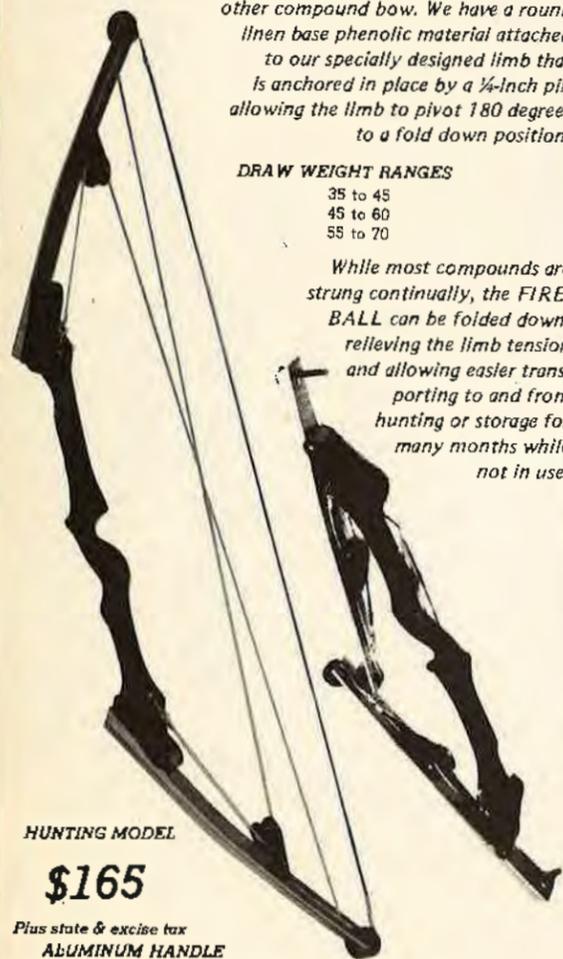
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WILLIAMS SETS PAA RECORD SCORE, BUTZ WINS SIXTH TITLE

John Williams, the 1972 Olympic gold medal winner, now a pro, put together rounds of 298-299-298-299/1194 to erase Vic Berger's record of 1190 and win the men's title at the 1975 PAA National Championship. And Ann Butz won the women's title for the sixth time, a record, with her 296-293-295-295/1173 tally.

Williams won \$1,000 for his efforts and Butz \$750.

After the first day's competition, John Williams and Bob Bitner led the field with 298, with John Kleman, Chuck Bigelow, Steve Robinson, Dick LaMar and Dave Miller all tied at 297.

On the distaff side, defending champion and five-time holder of the PAA title, Ann Butz, finished the day one point ahead of Judi Webber. Tied for third were Denise Libby and Marge Curry.

After the second day things opened up slightly with Williams missing a perfect 300 by shooting a four on the 55 yarder but gaining two points over Kleman. Third spot was held solely by "The Kid," Chuck Bigelow.

For the women, Ann Butz and Denise Libby both shot 293's which kept the lead to three points going into the third round of competition.

By the end of the third round, Ann had taken a commanding lead by scoring a 295. Denise held onto the second spot and Judi Webber was still in third. The men's positions stayed the same with Williams and Kleman both firing 298.

During the final round, Williams once again fired a 299 for a 1194 total and a new record. The old mark of 1190 had been held by Victor Berger since 1972. Kleman had some trouble in the 15-minute rain and finished with a 294 to tie with Greg Schumaker for second.

For the women, the defending champion made it six in a row as she fired another 295, nineteen points ahead of Denise Libby. Third spot went to Judi Webber with an 1152.

The weather was extremely hot and the conditions were nearly perfect with eight 299's being scored throughout the event, but no one was able to muster a 300.

One of the highlights of the event was the participation of Doug Brothers and Rick McKinney who flew directly from Switzerland where they had just competed in the World Championships. They arrived just in time to compete in the PAA National Amateur Division. Brothers fired a 1191, second high of the tournament, to take first and McKinney scored a 1186 to capture second place. Third went to John Bulcher with a 1165. Top amateur woman was Linda Curran with an 847.



From left, Judi Webber, Ann Butz, Marge Curry.



John Williams in his 1194 championship form. Photos by Diane Miller.

MEN

John Williams 298-299-298-299/1194
John Kleman 297-297-298-294/1186
Greg Shumaker 295-296-296-299/1186
Chuck Bigelow 297-296-296-295/1184
Steve Robinson 297-294-296-296/1183
Ed Rohde 295-295-297-295/1182
Dave Jackson 293-296-295-297/1181
Bob Bitner 298-290-296-296/1180
James McKinney 296-294-296-294/1180
Billy Freeman 294-292-299-295/1180

WOMEN

Ann Butz 296-293-295-295/1173
Denise Libby 287-293-288-288/1156
Judi Webber 289-287-291-285/1152
Jody Holder 282-284-287-283/1136
Marilyn Nicholas 285-279-270-288/1122
Maureen Bechdolt 280-279-270-288/1122
Barbara Kale 276-280-280-272/1108
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Texan Terry Ragsdale (right) stole the show at the 1975 NFAA Nationals with a near-perfect record 2766 aggregate in winning the men's open FS unlimited title. Below, pro unlimited women, from left to right, are Nikki Beaumont of Texas, winner Eva Troncoso of California, Nancy Pfeilmeier of New Jersey and Liz Colombo of California.



NFAA Nationals: Texan Ragsdale nearly perfect

IT WAS A banner year for the 1975 NFAA Nationals in Jay, Vermont, when 950 archers registered to shoot the championship tourney on July 21-25, the largest turnout since 1960. The IFAA World Field Championship was held in conjunction with the NFAA event. Some 60 archers also competed in this phase of the tournament, including representatives from Scotland, Mexico and Canada. A pair of NFAA amateur champions — Mike Flier, Illinois, and Butch Johnson, Massachusetts — took top international honors for the U.S. in barebow and freestyle competition, respectively. Flier's winning total was 2493; Johnson recorded a 2698.

The star of the tournament was 18-year-old Terry Ragsdale from Texas, last year's amateur unlimited titlist. Terry switched to the open division this year and had a near-perfect week of shooting firing rounds of 560/560/500/558/560

for the tournament-high aggregate of 2796 and a new national tourney record.

Those Precision-shooting Californians, Gale Cavallin and Eva Troncoso, led the pros in a week that was peppered with perfects on the field and hunter rounds. On Friday the pro division shot the new NFAA Identity round in place of the animal round. The Identity targets resemble the black-and-white field faces but have a slightly enlarged spot, wider white ring, and narrower black ring, to be scored 5-4-3.

Cavallin went into Friday's round tied with Lloyd Napier (OK) at 2236, and trailed by Stan Colombo (CA), Frank Pearson (NJ), and Ivan Winder (UT) with a trio of 2234's. Gale emerged the winner with a 544 Identity round score that gave him 560/556/560/560/544 — 2780 for the week. He collected \$1000 in pro division money.

Eva Troncoso put down a strong chal-

Pro unlimited men's finalists included, from left to right, champion Gale Cavallin of California, Stan Colombo, Lloyd Napier and Ivan Winder. Cavallin collected \$1,000 for his 2780 total.



lenge from fellow Californian Liz Colombo. Liz trailed Eva by 10 points the first three days and whittled that down to five going into the final round. Eva's strong 524 Identity round gave her 554/558/545/550/524 — 2731 for the week and \$500 first-place pro money.

Some new faces turned up in the barebow competition as Al Tuller, Missouri (2631), and Gloria Shelley, Connecticut (2224), took the open titles; and Illinois archers Don Morehead (2612), and Eunice Schewe (2132), took amateur honors. Perennial bowhunter champ Cal Vogt, California, averaged well over 500 to take his fifth consecutive national title.

Two strong Precision teams made a clean sweep in the manufacturer's team event. For the men, Gale Cavallin, Frank Pearson, Bill Shain and Dou Winklespecht collected \$800; Eva Tron-

(Continued on page 70)

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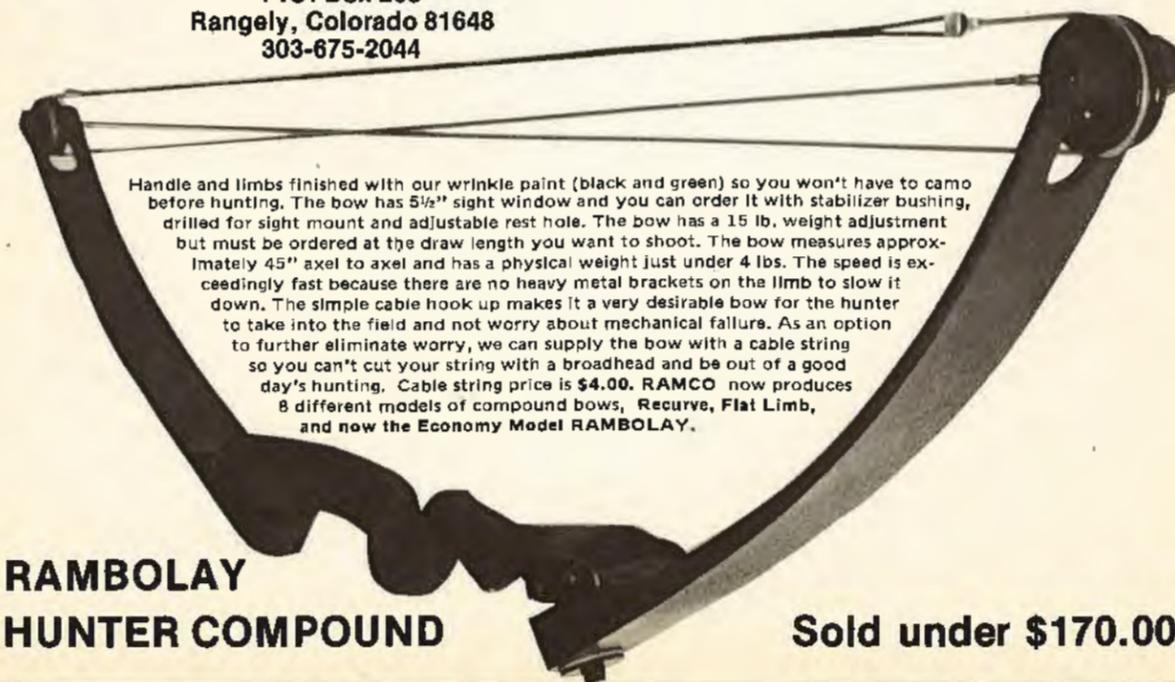
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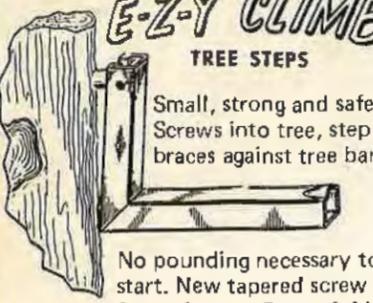
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BROADHEADS (continued from page 29)

complicate rapid healing and the animal, even though it recovers, will do so much more slowly.

It shouldn't take much of a bowhunter, when he weighs the pros and cons of a RAZORSHARP head over those of file or rough sharpened head, to see which one he should be using.

When bowhunters discuss broadheads on the market today there are many, many arguments on which heads are good and which are bad, but in my opinion, there are very few broadheads being marketed today that you can't get RAZORSHARP with a little work. If you use one that can't or won't hold a razor-sharp edge, then discard it and go to a broadhead that you can get sharp.

While we are on the subject of broadheads, there are a couple of other factors concerning broadheads that are sure to get an argument or two and maybe get you to thinking a little.

The standard broadhead is a two-bladed head and from there the market runs the gamut from auxiliary inserts for the two bladed heads to broadheads with up to six cutting edges. What is a bowhunter to buy to get the job done properly? There are good and bad points brought up everywhere about the different types of broadheads and their penetration vs cutting ability, etc.

A sharp two-bladed head will, in most cases, penetrate farther than a four or six bladed head due to the fact that there is less frictional drag on the two blades as opposed to more blades, but is penetration alone what you want? Many bowhunters believe that shooting an arrow completely through an animal will leave a better blood trail than having the arrow stay within the animal. In many cases this is quite true, at least in theory. An animal has a unique muscular system in that under the skin there are two opposing layers of muscle. If a two-bladed head penetrated these muscles and cut a hole through them, it would, in all likelihood, only cut across the grain of one of the layers and merely cut a slit with the grain in the other layer. This layer would then have a tendency to seal the wound very quickly and eliminate much exterior blood flow. If, however, you used a two-blade head, with a razorsharp insert, you would cut both layers and leave a much better blood flow and have a much better blood trail. If the arrow penetrated both sides of the animal. Suppose you didn't get complete penetration though and the broadhead lodged in the body cavity. Here the auxiliary blade that benefited you in cutting a larger entrance hole would now, in my opinion, be a disadvantage because the four blades would have a tendency to stabilize the head in the tissue and keep it steady rather than let it work freely and continue to use its

sharpness to cause further trauma and hemorrhage. If you could control all the variables such as exact hit location, animal's posture, muscle tension at time of hit, and many other such things, then you could more correctly ascertain whether or not you could best make use of a two-bladed head or a four-bladed head to obtain the maximum results. We can't control all the variables, so experience and preference will have to be your guides; but remember whichever way you go, make sure all the blades are RAZORSHARP.

Another point of contention between bowhunters is whether or not you should round the point of your broadhead or leave it fairly pointed. The main point here is to try to keep the point from turning or bending when you hit a bone. I personally don't think there is a damn thing you can do in this case except avoid hitting bones all together. The variables are just too much to overcome on this point with any degree of consistency and I also believe that one broadhead is not much better than another in this respect.

No matter what type of broadhead you use; two-bladed, four-bladed, or six-bladed, you are not always going to be able to overcome all the variables that you can run into while hunting.

The one variable that you can make constant, however, and the one that will literally give you the EDGE in your hunting, is to keep those broadheads RAZORSHARP!!!

ADDITIONAL BROADHEAD EFFECTS

Here is additional information gleaned from a conversation between Dr. Stringer and Archery World editor Glenn Helgeland:

Stringer has found shock effects up to six or seven inches in diameter around the broadhead entry wound, with capillaries destroyed and some blood in the meat. Shock waves will have a stunning effect on nerve endings, deadening the pain. Cutting itself causes little nerve damage or pain.

Dr. Stringer has seen three kills where the arrow went through the chest cavity with very little bone obstruction; the deer acted like it had received a mosquito bite, returned to browsing and then collapsed. The small shock must have deadened the nerves. "There obviously was no pain because the animal showed no alarm," Dr. Stringer said. Longtime bowhunters have most likely seen incidents like this, too.

Dr. Stringer said heavier broadheads produced more shock effect, but he is uncertain whether this was from the design of the broadhead or the weight; results have varied across the board with different bow and broadhead combinations without a specific pattern of results. However, a faster arrow will

produce less pain because it has more shock effect.

Pain receptive nerve endings are mostly in the skin. There are very few in muscle tissue. All viscera have nerve endings for only one sensation - distension (the pain of gas buildup). So a cut intestine or stomach won't cause pain. There is no pain in artery or vein cutting. On a paunch hit, if a large enough vessel is severed the animal will bleed to death long before peritonitis can set in, which usually takes about 48 hours, according to Dr. Stringer.

An excited animal creates an adrenalin effect, which can reduce the effect of pain or wipe it out. This is not an anesthetic effect, just a pain-stopping action.

"A good hit and subsequent hemorrhaging produces the same effect as a super fast drunk," Dr. Stringer says, "there's no pain, the subject just suddenly becomes unconscious."

On the other hand, starvation causes a great amount of pain, he points out. A starved animal has stomach cramps and is weak, thus is highly susceptible to infection and pneumonia. In addition, the gut loses its permeability and gets a bacteria infection from one end to the other.

WILD ANIMALS HEAL QUICKLY

On a well-managed herd, there will be little disease. A hunted herd of wild game will generally have a younger average age, and will thus be less susceptible to pain sources. Old animals have worn teeth, they can't feed as well, they get weak and starvation takes its painful toll.

Dr. Stringer points out that, in his experience, wild animals have much more resistance than inbred domestics, including humans. He feels there is almost guaranteed healing on superficial wounds of any kind unless the animal is old or weak or both. He has seen healthy animals taken with the bow that, upon butchering, produced a second broadhead from a long-ago hit seated right along a bone, with no signs of inflammation. And with a broken-off broadhead and short shaft section located internally, the body forms a cyst around it and walls it off.

From his zoo observations, he has noted that lacerations will heal quite swiftly by themselves. Animal licking removes potential infection and the roughness of the tongue debrides the tissue and takes off dead tissue. He noted that a horse at the zoo and a deer, with basically the same wounds, recovered at different speeds . . . the deer in 1 1/2 weeks and the horse in four weeks. He has also inspected deer that showed prior intestine damage but their system formed a fibrous mass around the wound and survived healthily.

Here are some additional points Dr.

Stringer made regarding broadheads, bows, hits and trailing:

Abdominal muscles have three angles or layers, but higher up on the body there are fewer muscle angles. Skin tension will help open up a round hole, which is why multi-bladed heads generally work best.

If all four blades are sharp, you should get penetration equal to that of a two-blade head. Insert blades must always be sharpened to produce best results.

Viscera is somewhat elastic, veins and arteries more so; another reason for razorsharp broadheads. A dull edge will slide around, and a feathered edge may just hook the vein without cutting it cleanly.

The diaphragm of an animal domes forward, so a hit in the rear of the rib cage will get the paunch or liver instead of the lungs.

Mis-identification of a hit can be, and is, a problem. Particularly when the hunter gets complete penetration, sees the arrow sail behind the animal and thinks he's missed. Fortunately, though, this is offset to a large degree by the fact that responsible bowhunters exhaustively search for the arrow or blood sign after a questionable shot.

Dr. Stringer discourages the long shot at game; at long distances there is almost no shock effect and greater chances for poor hits.

To get best results, don't overbow yourself. Shoot the heaviest bow draw weight that you can handle accurately. This will give better aiming, better arrow flight and probably better arrow speed, better arrow penetration, better shocking potential and all-around better results.

Softer tissues hemorrhage more than dense tissues. Dense muscles reduce penetration, which also lessens the shock. Muscle hits often show profuse bleeding, but the slowdown of blood pressure allows for quick clotting. The animal will take it easy and recover quickly. And since blood is like gas, in that a little bit can look like a heck of a lot, especially blood trail on snow, a bowhunter may mislead himself when trailing what he thinks is a good hit. (Regardless, the trail should be followed until you know for certain that the hit is superficial.) Major muscle or shoulder hits rarely are fatal unless the broadhead cuts a major artery, Dr. Stringer says.

Here's a trailing tip: Wounded hooved game spread the toes of their hooves, making a wider track that is relatively easy to discern. The spread hooves give the animal better footing and support. Lighter weight animals won't do this much; a weakened animal will do it most. Dr. Stringer noted that a tracker in Mozambique was able to follow at a trot a wounded impala in a herd of 50 by this method.



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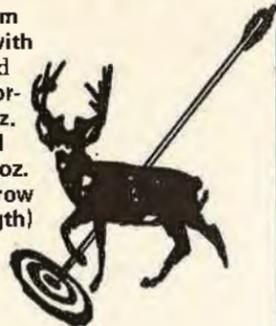
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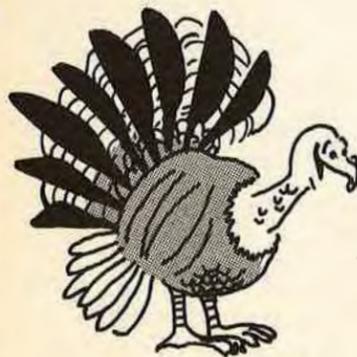
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BROADHEADS (continued from page 31)

handle serving the same purpose. Next, take the mill file and remove all the tool marks on the edges of the blade. Do not change the blade angle, simply lightly go over the factory sharpened blades and remove all tool marks, smoothing the blade. This is where many bowhunters would simply quit, leaving a feather edge which feels sharp, but will not properly do the job on a game animal.

Next, take the medium grit stone along with some type of cutting oil. Buck's Honing Oil or WD-40 work very well. Saturate the stone so there is plenty of fluid to keep the grit from getting into the stone and to keep the metal filings from clogging the stone's cutting surface. Lay the broadhead along the stone and, pushing it away from you, try to imitate cutting a thin slice from the surface of the stone. Push the broadhead away from you, turn it over and then draw it back, always sharpening into the edge of the blade. Ten or 12 strokes on the stone should be sufficient.

You will be able to feel the edge and actually hold it up to the light and see that there are no flat spots along the edge if you have done this properly. Turn the head over and do the same with the two opposing edges. Once this broadhead feels sharp to you, the edge is still going to be a little rough.

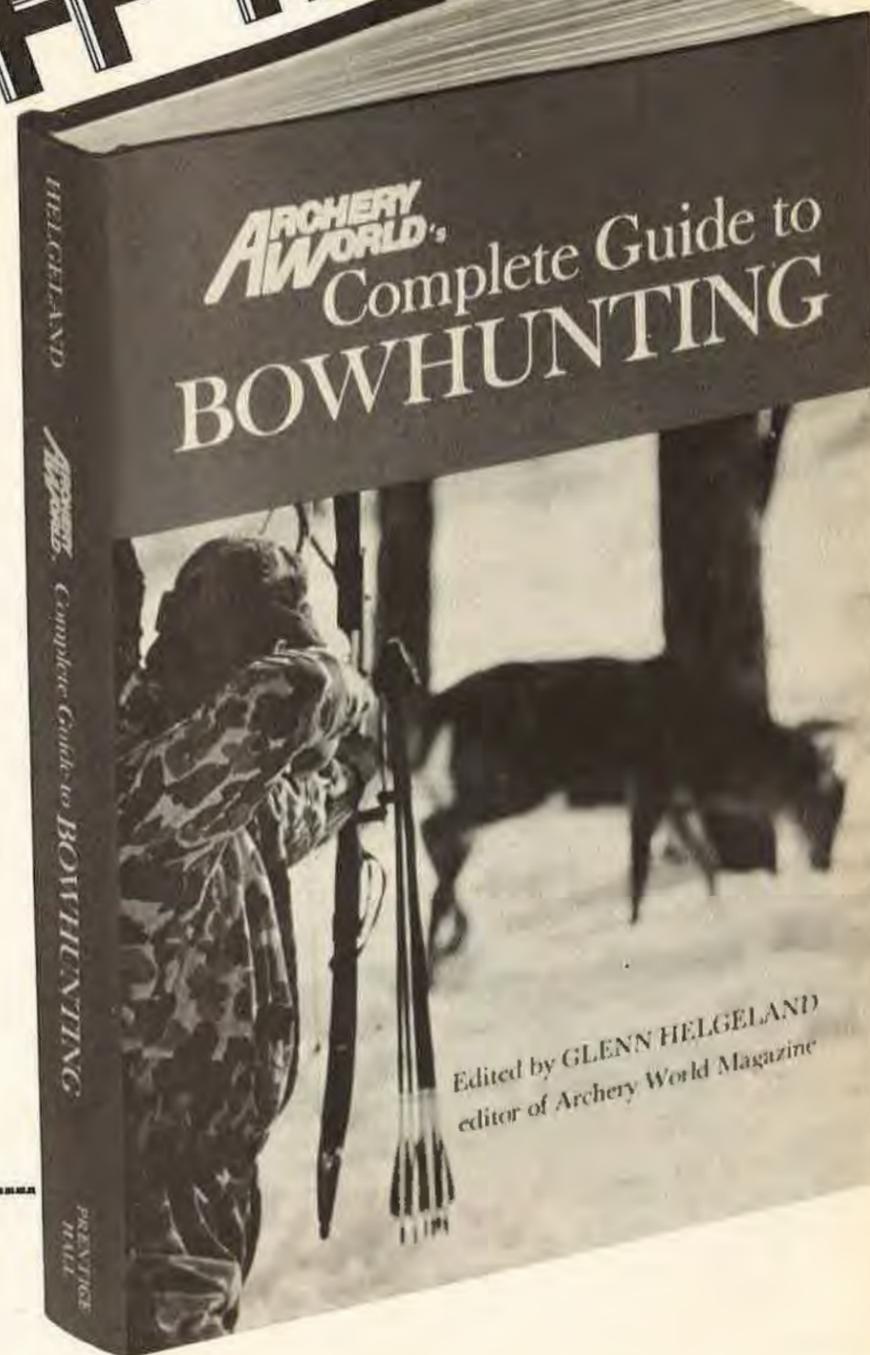
Next take the fine stone and again saturate it with a honing oil or WD-40 and repeat the procedure on this fine stone. You should definitely notice now that the edge is very fine and very sharp. It still needs to be touched up a little more so the following step is to take your razor hone and simply push the blade along the stone, turn it over and draw it back, trying to cut a thin slice from the stone.

When the blade feels razor sharp to you and there are no flat or rough spots along the complete edge of the blade, then take the strop, whether it be a razor strop or a piece of leather glued on a piece of wood, and strop the blade 10 or 12 times. In this procedure, strop the blade away from the center portion of the head. The strop is not doing any sharpening, it simply removes any very fine feather edges and polishes the edge of the blade. Ten or 12 strokes on each side of the blade on the strop should give you a broadhead that will easily shave the hair off your arm or your chin with one stroke.

The edge on this broadhead as you will soon see is not on the metal but rather in the metal. This broadhead will cut much cleaner, much smoother and stand up to much rougher usage than a broadhead with a file-shaped, burr edge to do the cutting. A little practice with the proper equipment and it will not be long before you will be reaching the two-minute broadhead mark.

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suffer crop damage from large deer herds and want more deer taken. But the state says, "No, unless you take down some of the 'no hunting' signs." Some farmers have done so, some haven't. If you intend to hunt this area, try state-owned land or get to know some landowners.

The first afternoon we scouted the area and spent the last couple of hours on stands Dave picked out. His favorite is in an oak tree about 10 yards off the corner of a corn field. A hedgerow runs down the side of the cornfield. There's a tamarack swamp just south of the field, and a beech ridge bordering the tamarack swamp above it. Below is a thick grass and goldenrod patch.

Deer run along the hedgerow, through the tamaracks and also through the willows on the lower side of the tamaracks. They also bed down in the tamaracks. The oak tree at the corner becomes the eye of the needle through which deer movement patterns must thread.

The two main trails cross about 15 yards from the oak tree, and since deer are just emerging from some really thick growth they usually pause here to look out into the more open areas before moving out to feed.

"That's when I shoot," Dave said. "I want the deer close. In the woods I won't shoot more than 25 yards, and in the open not more than 50 yards. They can jump the string at 50 yards, and on a calm day they can sometimes jump the string at 30 yards. Jumping the string can lead to a poor hit."

Wednesday night my wife, Judy, parked herself on that stand, the rest of us deployed to other good areas and we waited. Nothing. It was wet and gray, but the deer didn't start moving in the early grayness, probably because it was too wet to be comfortable.

Thursday morning, for variety, we tried the edges of a wheat field and a pine thicket. We came in at 11:30, everyone soaked.

Larry, after squirting another shot of buck scent onto his boots and hat, had spent several minutes trying to climb a wet beech tree . . . "but for every three feet I climbed I slid down four. So I gave it up and stood on the ground. I would like to have been above the deers' line of vision, because they would have been coming up out of a sharp gulley and could have had me silhouetted against the skyline. But I couldn't see myself attacking that tree for an hour, so I cut some branches to place in front of me and broke my back outline by leaning against a tree."

Dave commented, "I'm not sure deer are always looking at a hunter, anyway. Guys in a tree often think a deer is looking right at them. But it probably just has its nose up, scenting the air. Its eyes probably aren't focusing on anything. But the hunter doesn't know that, so he blows the whole thing by getting nervous and figuring he had better make his move. Best thing to do is just wait and see. That deer will probably turn its head . . . then make your move."

"Watch the ears, too. If they're flicking around, the deer is just searching. If it brings those ears around and stretches its neck a little toward you, you've probably been spotted."

"But let it make the first move when you feel it may have you pinned down. Their system is attuned to patient waiting, so if you don't do anything alarming you can wait them out."

With everyone dried out and changed to dry footwear — there's nothing to produce interminable misery like wet, cold feet — we scattered again to the wheat fields and beech ridges.

"We might as well hunt up here," Dave said. "We won't see as many bucks . . . they're hidden down in the thick brush in the valley bottoms and won't get out until the squirrel, rabbit and turkey hunters start moving them this weekend. We'll hunt down there then."

Larry added a couple shots of buck scent before he left camp. "The wet grass probably washed off all I put on this morning," he explained when five other people stood there

looking at him. From upwind.

He may have been right. He found a beech tree that had had its main stem broken several years ago and now formed a natural seat of branches. He sat in it for a while, then moved to another tree down the ridge farther.

"The wind was blowing up the ridge, so I went to the other side of the deer trail and around the corner of the field."

He also saw nine deer that evening, getting one shot at a nervous doe and two at another doe.

"I might have had the second one," he said later, "but I hit a stick."

... AND THEN IT SNORTED AT ME 46 TIMES*

That stick is the same one you see elsewhere on these pages immortalized as the only Pole-killed pole in western New York.

One doe came out just as he was about to leave. "It stopped on the edge and then bolted back into the woods. I whistled. It stopped, turned around and then snorted at me 46 times . . . I counted the snorts. Then I snorted back and it snorted again and took off."

"They say a deer snorts to clear its nose. So you must stink like hell," Dave said.

"That buck lure is just getting ripe."

"I don't know about it, but you sure are," Dave concluded.

That night we discussed these and other things relative to deer hunting; the qualities of Genesee Cream Ale (it's good), the fact that someone had stolen the outhouse door and various other matters important to all deer hunting camps.

We decided to try the bottomlands the next morning and not wait for the hunters.

Dave put Judy in a typical Dave Young tree stand — 12 feet off the ground, two steps to reach it, no branches in between. To get into such a stand you wrap one leg around the far side of the tree, crook your other leg on the near side of the tree and squeeze. Then with this absolutely dead certain perfect grip on

the tree (they were wet, remember), you reach as high as you can and hook your fingernails into anything that looks like tree bark. Tightening your fingernails, you now release your legs and either swing your body upward for a new grip or simply hunch your back and draw yourself up like a vertically moving inchworm.

Really, it's very simple. Any orangutan can easily duplicate it.

Anyway . . . the creek bottom we hunted that morning looked about as "deery" as a creek bottom can look. Impenetrable brush. Goldenrod patches in the open areas. Sumac thickets up the slopes, opening onto beech benches. A few alders where there actually was a small swampy patch. Small patches of blackberry canes.

And Larry up on the ridge, buck scent in hand. Judy had a forky buck come in from behind her at 9 a.m. It didn't like what it saw or smelled and stopped in some thick brush with only its head showing. "I was at full draw when it stuck its head out," Judy said. "One more step and . . . but then it just backed up and melted away. I couldn't have gotten a tank through that brush, much less an arrow."

That afternoon we headed back to the ridgetops, and it worked. Neil sat along the edge of a wheat field in another Dave Young tree stand, in the same place Judy had sat the night before, and five does fed out of the beeches at 5 p.m. Feeding slowly, they came within range at 5:25 p.m. and he took a 35-yard shot at the biggest doe. The arrow sliced through the kidneys and she piled up, running, in less than 90 yards. The entire shot sequence probably consumed no more than five seconds. Quick and efficient.

That same night a doe and her two almost-fully-grown fawns walked cautiously out of the goldenrod field just north of my tree stand. The doe saw something (me, apparently) in the tree that she was unsure of and looked the tree over

(continued on page 62)



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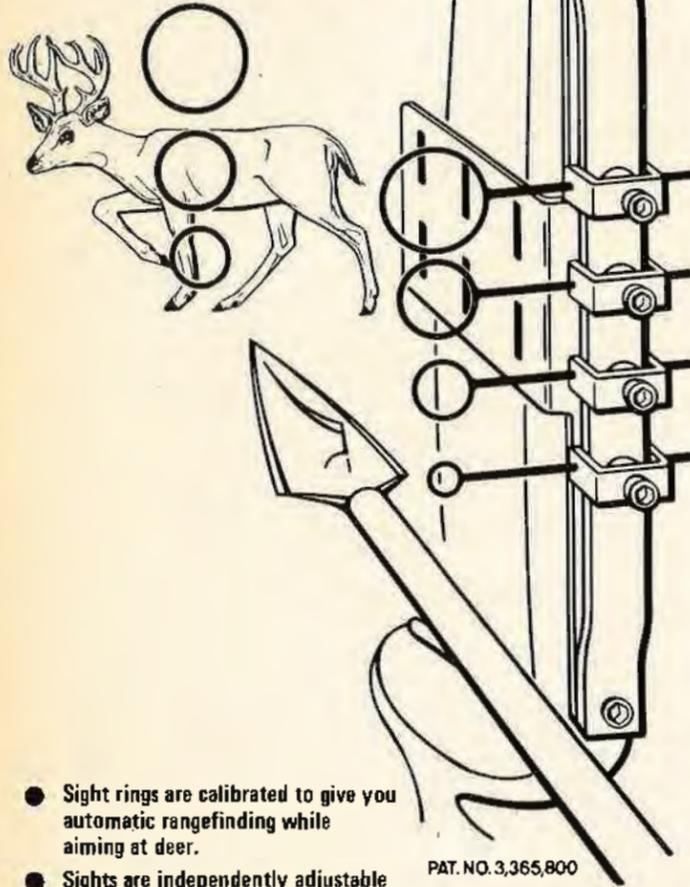
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(continued from page 59)

thoroughly. I was wearing a red/black checked wool shirt — it was warm, so I had taken off the camo jacket — but I remained motionless and she finally satisfied herself that there was no cause for worry. She walked almost directly under my stand, but like an idiot I drew on her because she was the largest. I should have waited and taken the second trailing fawn as it walked past me. The upshot of the whole sequence is that the second trailing fawn saw me move and spooked them all. The lesson is that when you're hunting out-of-state for only a few days, you stand a good chance of going home skunked if you try for the largest deer instead of the best shot.

Judy and Derek both missed shots at does that afternoon, so there was no shortage of action.

A first-year bowhunter Dave knows had hunted this general area since opening day. He had taken 29 shots and was now working on his third dozen arrows. He had begun with aluminums, then fiberglass and was now shooting wood shafts. He figured if he was going to keep losing arrows he had better shoot something he could afford. Yes, Virginia, there are deer in New York, about 400,000 scattered through the habitat.

Saturday morning was so heavy with fog that the cold dampness penetrated clear down to the bowhunter's soul. Even the red squirrels and bluejays were quiet. The wind switched directions like a wild gypsy dancer and small yellow moths that looked almost like falling poplar leaves fluttering from the trees were about the only signs of life in my area.

But Dave's favorite oak tree stand on the cornfield edge finally showed Judy a deer. However, she overcompensated for her low shot of the previous evening and made a beautiful 18-yard shot on a 15-yard spike buck. It glanced at the arrow that hissed over its back and then wandered up the trail behind a thicket of brush. Dave's cousin, Gordon, missed a shot at a forked down in the river bottoms.

We drove to town that night for a look around. Larry had to throw his hat in the back of the pickup truck because you couldn't live with it in an enclosed place like the cab.

"I don't think my wife will let me in the door with that thing," Larry admitted.

So that night when we returned to the cabin we made sure she wouldn't. Larry went outside to get something from his car and while he was gone we dumped a full bottle of buck scent on his undershirt. We stuffed it inside his pillow case and squirted more scent on the pillow case. Then we all sat around looking innocent as newborn babes.

Larry came back in, dumped his belongings near the stove, allowed as to how he was quite tired and sacked out.

It took him longer to get to sleep that night because every so often he'd mutter something about "Gawd, I can smell that scent everywhere. My wife's not gonna let me anywhere near the house," and then turn over and try to sleep.

The next morning he went back outside for a couple of seconds. We removed his undershirt from the pillow and hung it back on the clothes rack. He came back in, put it on and said, "Let's go hunting."

We went hunting for a few hours, and then headed home. But we don't know whether Larry's wife let him in the door or not because we didn't tell him the saga of the scented shirt. We figured we'd let him find it out when he reads this.

Enjoyed your company, Larry, as long as we were upwind. Deer bow season dates for 1975 are Oct. 1 - Oct. 24 in the northern zone and Oct. 15 - Nov. 16 plus Dec. 10 - Dec. 14 in the southern zone. The late season following the firearm season in the southern zone is new this year.

Residents must buy a \$5.25 big game license and \$4.25 bowhunting stamp. Non-residents must buy a \$52.50 big game license and \$4.25 bowhunting stamp, and show proof of a previous hunting license in their home state or New York.

For full information on New York State hunting areas, write to the Division of Fish and Wildlife, Department of Environmental Conservation, 50 Wolf Rd., Albany, N.Y. 12201.

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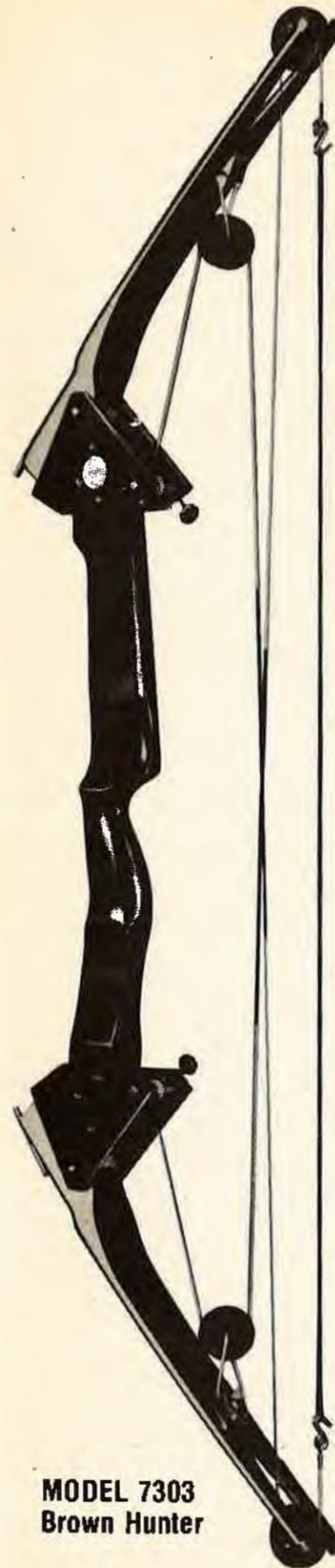
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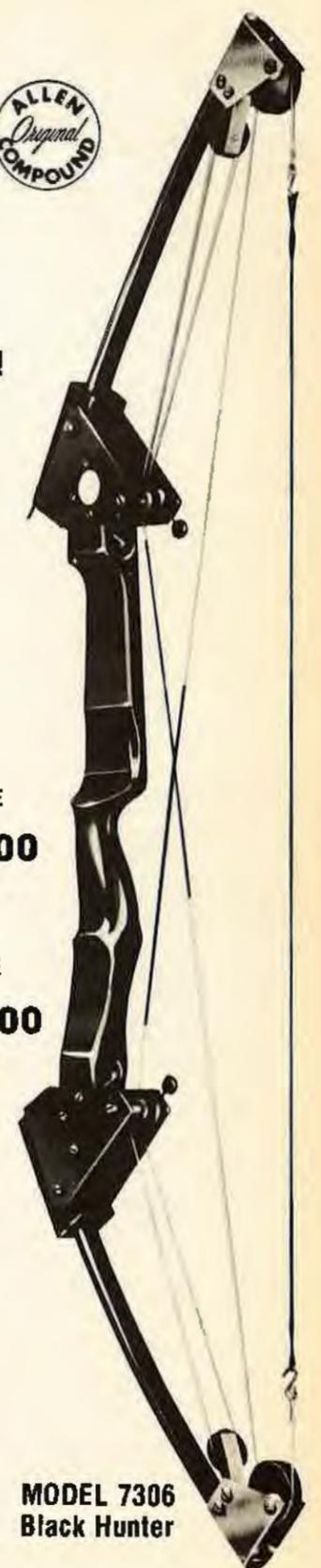
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degree that you can make it work. Don't expect topline, potentially highly critical equipment automatically to solve shooting or equipment problems you may have. You can tie yourself in knots doing this and be more confused than when you started.

4) *Stabilizer length and weight.* When you release the arrow, there's always a pressure point where the arrow pushes against the bow, and the bow against the arrow. A heavier bow will move sideways less, and will thus force the arrow out around it somewhat. To straighten out most quickly, the arrow thus must be a little heavier (stiffer). A sight window cutout to or past center minimizes this to a degree, but the factor remains.

Accordingly, the heavier and/or longer the stabilizer rod, and the heavier the ball, the heavier the arrow weight you will need. With compounds in the three-and-a-half-to five-pound mass weight range, you can still shoot a "light" arrow. But when you get above that you had better plan to go up in weight, like maybe one size from 1814 to 1914. Experimentation will show what works best for you.

5) *Drawing to the "stop."* A lot of people don't understand the position of the stops in relation to minimum holding weight. Basically because you don't hit that wall of tremendous resistance until you're an inch-and-a-quarter to an inch-and-a-half past the minimum holding weight. You're on the back side of the valley in the force-draw curve and you could be holding as much as three or four pounds higher than you think you're holding.

This is one of the main reasons people have had to shoot heavier arrows than anticipated to get good flight.

In almost all cases you're better off having a bow with stops set on the long-draw side. This gives you an inch on either side of the minimum holding weight without too much change in holding weight. This can be beneficial in hunting when you're

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not certain that you always come to the same draw length before shooting.

6) *Letoff at full draw.* There are obvious tradeoffs when you consider big letoff against small. A bow with small letoff has a crisper string feel. It stores more energy than a bow with big letoff. It doesn't magnify shooting errors as much because it will be less handle-sensitive and there isn't as much string oscillation on release. So if you want the full-draw comfort of a big letoff, be aware of the sacrifices you're making to get it.

An archer with good shooting form can use a bow with bigger letoff than can someone with less consistent form, simply because he doesn't need equipment as highly forgiving.

7) *Weight of arrow points.* Any way you can lighten the weight of the point effectively increases the in-flight (dynamic) spine of the arrow. One way you can do this is to cut off part of the shank of the target point or broadhead adapter. Doing so, you must be careful to get the right amount of glue on the shank or the weight will vary slightly from arrow to arrow. This is obviously more critical for target shooting than hunting. Once in a while you will lose a point, but not very often.

The result of this lightening is that you can go down an arrow size and still get good performance while picking up a few more feet per second.

8) *Nock fit on the bowstring.* Your nocks should snap on the string, but the string should be able to rotate slightly. This isn't super critical, but a string that fits so tight it spreads the ears of the nock will cause the arrow to hang up slightly on release. Speed nocks obviously won't snap on the string, but they shouldn't be sloppily loose either.

9) *Nock protection.* Release shooters would have better results if they used some sort of small rubber bushing on the string, fitted just below the nock. This takes the pressure off the bottom of the nock and helps get better arrow flight. Lee's Archery makes a good one called the Eliminator Button.

10) *Sight window cutout.* The bow should be cut at least 3/8-inch past center for optimum performance. If it is cut more than that you will run into problems building out the arrow rest.

You can check the adequacy of your bow's cutout, and your tuning, with the spray powder routine. For this check, either spray the arrow and see where powder is marked on the window, or spray the window and see if the vanes mark it. If there is a mark you probably will have to go to a heavier arrow or cut out some of the window.

11) *Arrow wall thickness.* You should be able to get good arrow flight with .016" wall thicknesses or less for target arrows. If you go above that you're sacrificing speed because of the weight.

With HUNTING arrows, you should not need a wall thickness above .018". Thicker-walled arrows are really telephone poles and slow. The 2117 is one of the best shaft sizes for heavy hunting bows. Some XX75 shafts that will cost a little more but will be worth the money are the 2213, 2114, 2013 sizes. They're light and will shoot like darts when properly tuned.

If you're going to a less expensive shaft like the Game Getter, the .018" wall is a good thickness.

MAKING THESE UNITS WORK

So how do you tie all the checkpoints together for good arrow flight?

You begin by properly preparing your equipment before you even shoot an arrow. You'll note that many of these checkpoints are simply mechanical. Then you work on your shooting form, being careful that you draw to your proper draw length.

From there, the arrow rest is the best place to begin fine tuning. If the arrow doesn't clear, move the rest in or out, or adjust the plunger if you're using one. Shaft stiffness can be related, too. If your arrow is spined too light, the arrow still will be bent when it goes past the rest and won't clear properly.

Nocking point location is another factor. If it's too high, your arrow will flip tail end high but will shoot low. If it's too low, your arrow will flip nock end low and shoot high.

With good tuning of light arrows you will get some super speeds. Pete Shepley's bow peaks at 65 pounds and holds 47. He shoots a 2213 arrow, 30½ inches long, four-inch vanes and Wasp heads. Using a ledge release, he gets 218 feet per second.

"That's a dynamite speed for a hunting bow," he says. "Any hunting arrow going 200 or more feet per second is fast. Speeds of 180 feet per second are good."

He has not had good results shooting fiberglass hunting arrows from compounds. They don't dampen out quickly, so you almost have to spine for the peak weight of the compound to get good flight and you lose speed. Wood arrows dampen much faster than glass; aluminum is best of all.

KEEP HUNTING TACKLE SIMPLE

The main thing to remember when setting up a hunting bow and arrows is to keep the system as simple as possible. You must have confidence in your shooting tackle and in your ability to shoot it properly under stress conditions. Since you probably won't be double checking your shooting form when shooting at game, the most foolproof and forgiving system you can devise under those conditions will give you most confidence and best results.

Some fine tuning items, like a highly sensitive arrow rest, may not perform well for you when you are excited. The only way to find out is to try them in simulated conditions, and in actual conditions if you have the nerve. You may need to make trade-offs — decreased speed for fewer tuning problems, heavier arrow spine to handle a heavier broadhead, maybe a very slight helical fletch to gain more arrow stability.

When you're practicing, be sure the field points weigh the same as your broadheads. Maybe even go five or 10 grains heavier with the field points, if you can, as the blades of a broadhead often create the same effect as a few grains of extra weight.

The average guy probably will want to use screw-in heads because they are easier to use. If you use them, be very careful you get the broadhead mounted straight. If the broadhead is not mounted perfectly, you will get all kinds of results which mistakenly indicate improper arrow spine. The full length taper of a standard broadhead adapter makes it much easier to mount a broadhead straight.

As you work toward a finely tuned system, be sure you do all your shooting with a filled quiver mounted on your bow (of the type quiver you will use when hunting). A filled bow quiver adds mass weight, which makes the bow react differently; it stays more in line and forces the arrow out around it, which means you may have to go to a slightly stiffer arrow. Front-mounted quivers are the best because they act like a stabilizer.

The size of the broadhead you're using will affect the size of the fletch you use. Fletching, not the broadhead, should steer the arrow, and you should use as small a fletching as possible. With the larger broadheads, or arrows longer than 30 inches, you probably will have to go to five-inch fletching. A larger broadhead sometimes seems to create an air turbulence which keeps the fletching from getting proper air flow to control the shaft.

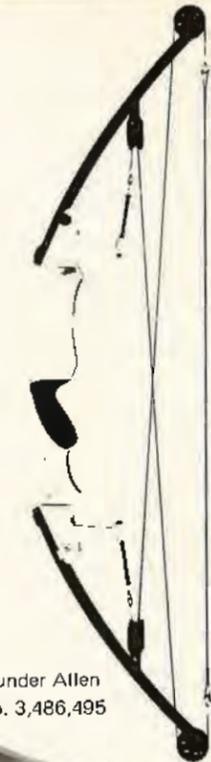
But this added weight and fletching partially defeats your purpose — arrow speed. Within the standards of safety, to keep from cutting your bowhand fingers, keep your arrow length as short as possible and thus hold the weight as low as possible.

Whether to use three fletches or four is another personal choice. Some compound shooters prefer three because they are angled 120 degrees apart versus 90 degrees or 105 degrees for the two four-fletch styles and will be less apt to turn the vanes into the cables. On the other hand, four fletches will have a lower profile (under the theory that four smaller fletches will equal the effects of three larger fletches). Shoot whichever system works best for you and gives you the least worry.

You will need to practice and experiment to reach a highly tuned system. The results are worth it, for you'll be getting the best performance you can from your archery equipment.

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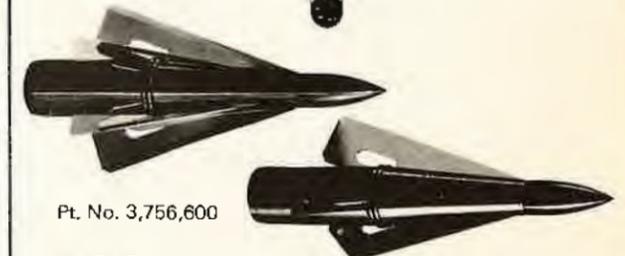
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(continued from page 35)

incorrect belief, according to McCrary. "Roy says manufacturers and bowhunters wanted a long slicing surface and a certain amount of broadhead width. A solid blade with the desired length and width would be too heavy to shoot, so by making the barbed design they reduced the grain weight and got the necessary width while retaining the basic strength," McCrary adds.

The old barbed heads were thus a style of cutout design, but true cutouts with a forward sloping rear edge of the blade basically began with the Bear Razorhead in the early 1950s. The Goshawk is another early example of the true cutout design.

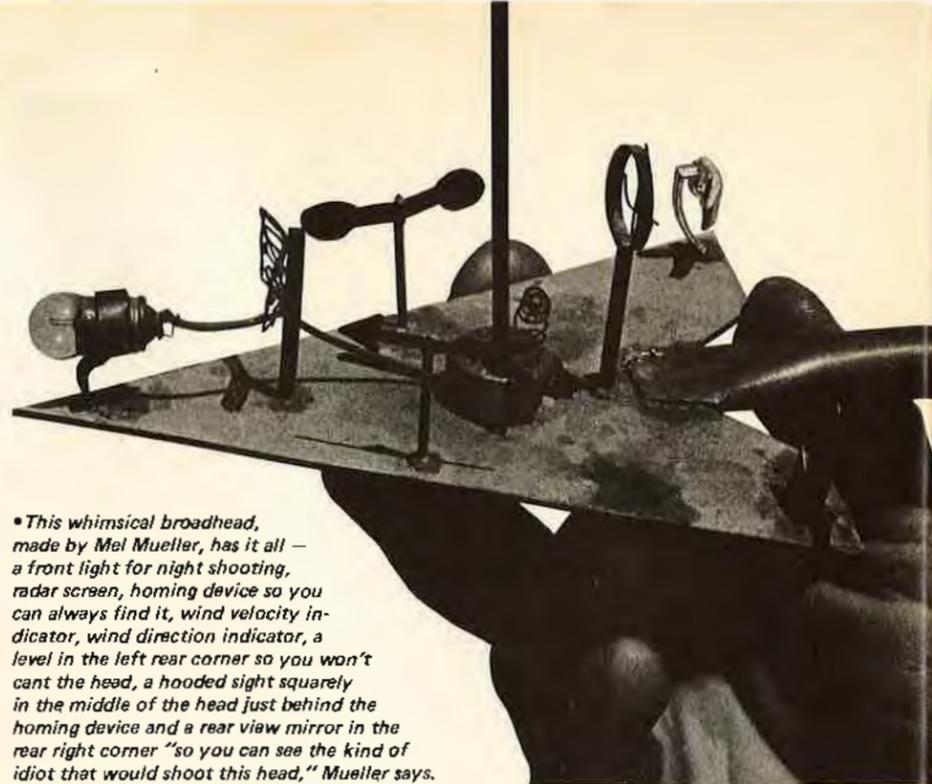
Grain weights vary considerably; samples in various collections range from 60 grains to well over 380 grains. Most manufacturers today stay basically within the 100- to 150-grain range.

The designs are endless. There's a head that opens like a scissors, heads that look like maple leaves, nylon heads for small game hunting, heads with spiral blades, heads that look like corkscrews, one head that looks like a pizza cutter, heads that look like rocket ships, and heads that defy description. Some look like they could easily be sharpened; others look like they couldn't be sharpened in a million years.

Most collectors have established a basic genealogy for the major heads . . . the 1940 Double Wing Sure Thing begat the 1942 Triple Wing Sure Thing begat the 1946 Triple Wing Never Fail, ad infinitum. (To some, ad nauseum.)

"The fun is in establishing, on a written-down record basis, the evolution of these things, seeing how they changed and developed, seeing how various successes or failures influenced the manufacturers' thinking and production," said Jim Ellis, Paterson, New Jersey.

A bunch of ABCC members got



• This whimsical broadhead, made by Mel Mueller, has it all — a front light for night shooting, radar screen, homing device so you can always find it, wind velocity indicator, wind direction indicator, a level in the left rear corner so you won't cant the head, a hooded sight squarely in the middle of the head just behind the homing device and a rear view mirror in the rear right corner "so you can see the kind of idiot that would shoot this head," Mueller says.

together in May at Bernie Giaccolletto's Bowhunter's Festival at Clinton, Indiana, to swap everything from lies to broadhead descriptions to broadheads themselves. Most brought along a couple of old broadheads they couldn't identify, hoping that some other member could help them.

"You know what they look like?" one woman said, pointing to four broadhead collectors huddled on hands and knees around a small cardboard box. "They look just like boys playing marbles."

Then she shook her head in amazement.

They might be amazing . . . those metal and plastic dreams and realities.

But that opinion hit home. I was one of those four and I was having fun.

So the next time that woman says something about "marbles," I'm going to lean across the breakfast table and hit her right on the ear.

And then I'm going to go down in the basement and play with my marbles . . . er, broadheads.

If you're interested in broadhead collecting, write to Jim Ellis, Membership Chairman, ABCC, 39 Highland St., Paterson, N. J. 07524 and he'll send you information on the American Broadhead Collector's Club. The ABCC is now just over a year old and has members all over the United States and a few in Canada. In addition to McCrary and Ellis, officers are Dave Elliott, Houston, Texas, vice president; Mel Mueller, Danville, Ill., secretary-treasurer.

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$$\text{Efficiency \%} = \frac{W_a V^2 \times 100}{450800 \times E_s}$$

$$\text{Efficiency} = \frac{484.75 \times 173.45^2 \times 100}{450800 \times 43.23}$$

$$\text{Efficiency} = 74.8\%$$

We can compute bow efficiency for different arrow weights and respective velocities and show that efficiency increases with arrow weight. This is true up to a point generally well beyond common practice in matching arrow weight to bow draw weight and draw length. Usually the peaking of the efficiency curve occurs at much heavier arrow weight than is ever practically shot from the bow because you encounter the problem of an extremely slow arrow.

We like to see arrow velocity and bow efficiency tested and presented for a range of arrow weights encompassing variations of shaft size that typically might be shot from a given bow under field and hunting conditions. Usually this will cover a range of 100 or more grains and provide an excellent index to the bow's performance.

Most experimental data is subject to some, hopefully small, experimental error. To compensate for this, it is common practice to run duplicate tests and average the results. Depending upon the consistency of velocity readings, we will shoot a given arrow from a minimum of three times to as many as 15 to 20 times to assure ourselves that the results are representative. If at all possible, we like to see arrow velocity readings fall within a maximum range of 1.5 feet per second before averaging for the experimental value. In many instances, we have had repetitive shots correlate within a total spread of velocity of 0.5 feet per second.

Another authoritative check on the validity of experimental velocity determinations is readily obtained by a plot of the experimental data for various arrow weights and the use of a curve-fitting technique based on Dr. Paul Klopsteg's concept of "virtual mass." This term is interchangeable with "effective mass" which is probably in wider use. The original introduction appeared in an article entitled "Physics of Bows and Arrows" by Paul E. Klopsteg, published in the American Journal of Physics, Volume 11, Number 4, August 1943 and was repeated in a book he co-authored entitled "Archery — The Technical Side."

The author defines "virtual mass" as "a mass, if it were moving with the speed of the arrow at the instant the latter leaves the string, would have precisely the kinetic energy of the limbs and the string at that instant."

Dr. Klopsteg let "K" represent the virtual mass of a bow, and wrote:

$$rW = \frac{1}{2}(m + K)V^2$$

where W = energy required to bring the bow to full draw
 r = fraction of input energy remaining after deducting hysteresis loss
 rW = available energy
 m = mass of the arrow
 V = velocity of the arrow

He further determined, by testing a large number of bows, that K, the virtual mass, was essentially a constant (as its designation might indicate) for a given bow.

Note that by using "available energy," Dr. Klopsteg avoided the inclusion of the hysteresis loss in the "virtual mass."

Hysteresis in the self bows of that era was significant, and as near as I can determine measured bow efficiencies were not always penalized by being based on the total work exerted to draw the bow. Instead, efficiency was calculated from a base value of total expended energy minus the amount of energy lost to hysteresis in the limb material. Hence it represented "net efficiency" rather than "overall efficiency."

In present practice, where modern materials and construction have greatly reduced hysteresis loss in conventional bows, it is more common to include the effect of hysteresis loss in the value of "virtual mass" and also to express efficiency as an "overall" value. This will account for the fact that excellent contemporary efficiency values lie in the mid-80 percentile range, while researchers like Hickman and Klopsteg mention efficiency values of 94 percent. The difference can probably be attributed to the disparity between "overall" and "net" efficiency.

If we rewrite the Klopsteg formula and include the hysteresis effect we have Formula 5) $E_s = \frac{1}{2}(m + K)V^2$ where E_s = stored or potential energy (area under the force-draw curve) and the other values are as previously stated.

USE OF 'VIRTUAL MASS' VALUE

Now when we calculate "virtual mass" from chronograph data it may have a somewhat higher value, but its characteristic as a constant should not change, at least for conventional bows. I have found that for compound bows the values of virtual mass obtained from experimental data appear to have a wider variation from a mean value. This is probably due to variation in friction in the compounding system from shot to shot and from arrow to arrow. This means that extension of arrow velocity data based on the virtual mass of the bow will be somewhat less dependable.

The principle use of the "virtual mass" value for a bow, other than direct comparison for evaluation, is in the extension of arrow weight-velocity curves for a given bow and for curve fitting when plotting experimental arrow weight-velocity data. We use it upon occasion for the first purpose, but we employ it for curve fitting for every arrow weight-velocity chart that is prepared.

The technique is based on the following manipulation of formulae (1) and (5):

$$1) E_k = \frac{1}{2}mV^2$$

$$5) E_s = \frac{1}{2}(m + K)V^2$$

rearranging Formula (5) we have:
 $E_s = \frac{1}{2}mV^2 + \frac{1}{2}KV^2$
 substituting from (1):
 $E_s = E_k + \frac{1}{2}KV^2$
 again from (1) we have:
 $V^2 = \frac{2E_k}{m}$

substituting for V^2

$$E_s = E_k + \frac{K}{2} \frac{2E_k}{m}$$

or $E_s = E_k + \frac{K \times E_k}{m}$
 and $\frac{K \times E_k}{m} = E_s - E_k$

Solving for K (the virtual mass)
 Formula (6) $K = m \left(\frac{E_s}{E_k} - 1 \right)$

From our force-draw curve and chronograph tests all data is known and we can compute the virtual mass (K). In this instance, if we express the mass of the arrow in grains, the virtual mass will also be in grains since the conversion factor (from slugs to grains) will appear on both sides of the equation and cancel. Therefore . . .

$$K(\text{grains}) = W_k = W_a \left(\frac{E_s}{E_k} - 1 \right)$$

E_s is the stored energy from the force-draw curve in foot-pounds. E_k is the kinetic energy of the arrow in foot-pounds derived from the chronograph tests and Formula (1).

Sample:
 $W_k = W_a \left(\frac{E_s}{E_k} - 1 \right)$

$$W_a = 454.5$$

$$E_s = 43.23$$

$$E_k = 33.03$$

$$W_k = 454.5 \left(\frac{43.23}{33.03} - 1 \right)$$

$$W_k = 454.5(.309)$$

$$W_k = 140.44 \text{ grains}$$

Note: The average value of virtual mass calculated for feather fletching for this bow was 143.8 grains.

Now that we have determined the virtual mass for the bow — we use the average value calculated from all arrow weights and velocities as tested on the chronograph — it is possible to select any arrow weight we desire and compute the velocity for that arrow when shot from the test bow under the same conditions of test.

We use Formula (5) for this purpose and solve for V (the arrow velocity):

$$(5) E_s = \frac{1}{2}(m + K)V^2$$

$$V^2 = \frac{2E_s}{m + K}$$

$$(7) V = \sqrt{\frac{2E_s}{m + K}}$$

Again, this is expressed in the absolute system — in order to use grain weights for "m" and "K" we must enter the conversion factors:

Formula 8) $V = \sqrt{\frac{2 \times 7000 \times 32.2 E_s}{W_a + W_k}}$

$$V = 671.4 \sqrt{\frac{E_s}{W_a + W_k}}$$

V will be in feet per second
 E_s will be in foot-pounds
 W_a and W_k are in grains

To use Formula (8) for curve fitting when plotting experimental data it is only necessary to select convenient

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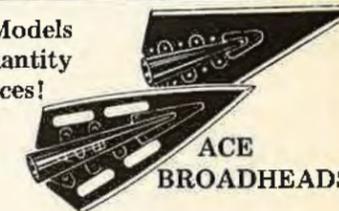


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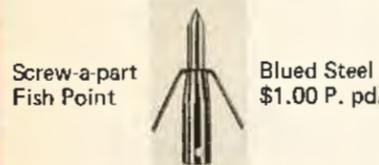
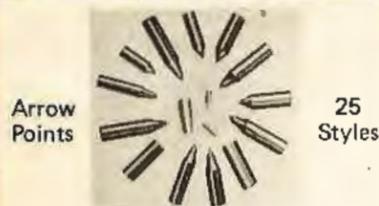
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BOW TESTS (continued from page 69)

values of arrow weight at uniform increments over the approximate range of the test. With the virtual mass determined from the average of test data, the corresponding velocities are computed and plotted along with the strictly experimental points.

Sample:

$W_k = 143.8$ grains		
$E_s = 43.23$		
W_a	$W_a + W_k$	V
350	493.8	198.6
400	543.8	189.3
450	593.8	181.2
500	643.8	173.9
550	693.8	167.6

Example: $V = 671.4$

$$V = 671.4 \sqrt{\frac{E_s}{W_a + W_k}}$$

$$V = 198.6 \text{ ft. per second}$$

CURVE AVERAGES OUT ERROR

The curve through the calculated velocity values will be an average arrow weight-velocity curve for the bow tested and should average out most individual experimental error.

The same technique is used for the plot of efficiency versus arrow weight using the uniform increments of arrow weight and the virtual mass as follows:

$$\text{Efficiency} = \frac{E_k}{E_s} \times 100$$

$$\text{Efficiency} = 100 \left(\frac{\frac{1}{2} m V^2}{\frac{1}{2} (m + K) V^2} \right)$$

(9) $\text{Efficiency} = 100 \left(\frac{m}{m + K} \right)$

Since the conversion factors cancel . . .

$$\text{Efficiency} = 100 \left(\frac{W_a}{W_a + W_k} \right)$$

where W_a is the arrow weight in grains
 W_k is the virtual mass in grains
Since these values are already available from the velocity calculations, it requires but a flip of the calculator to obtain the efficiency curve.

W_a	$W_a + W_k$	Efficiency
350	493.8	70.9%
400	543.8	73.6%
450	593.8	75.8%
500	643.8	77.7%
550	693.8	79.3%

Sample:

$$\text{Efficiency} = 100 \left(\frac{350}{493.8} \right)$$

Efficiency = 70.9%

* We believe that performance data derived in this manner is the most representative data possible, and for this reason the *Archery World* bow tests are prepared employing this technique. Certainly it requires more effort, but it tends to point up erroneous data so that it can be rechecked or eliminated. We feel that the end result is representative, comparative and credible.

NFAA (Continued from page 53)

coso and Mary McCoy shared the women's purse of \$400.

Aside from Monday's on-again, off-again rain that can at best be described as "torrential," the shooters were pleased with the nine scenic courses and four days of fair, though very hot, weather. A steady week-long wind challenged the shooters on two open courses; the remaining targets were well-wooded. Four-position shooting on all targets kept the tournament well on schedule.

It was a superlative effort on the part of the sponsoring Jay Peak Lodging Association and NFAA officials, whose on-the-spot maintenance crews throughout all the courses seemed to alleviate problems before they started. What began as a good tournament on Monday became one of the best by Friday!

by Phyllis Butters

The winners: Pro division — men unlimited, Gale Cavallin, 2780; men limited, Dave Grimsley, 2639; men bowhunter, Bob Jensen, 2075; women unlimited, Eva Troncoso, 2731; women limited, Marita Gilmer, 2457. Open division — men unlimited, Terry Ragsdale, 2796; men limited, Dick Phillips, 2708; men barebow, Al Tuller, 2631; men bowhunter, Cal Vogt, 2550; women unlimited, Barbara Morris, 2746; women limited, Lois Potter, 2558; women barebow, Gloria Shelley, 2224; women bowhunter, Jeanne Owen, 1846. Amateur division — men unlimited, John Ashburn, Jr., 2778; men limited, Luke Wood, 2784; men barebow, Don Morehead, 2612; men bowhunter, Charles Maloney, 2196; women unlimited, Michelle Sanderson, 2689; women limited, Barbara Brown, 2305; women barebow, Eunice Schewe, 2132; women bowhunter, Deborah 'Half-penny, 1537.

Young adult division — unlimited boy, Robert Ambrose, 2758; unlimited girl, Vanessa Womack, 2509; limited boy, Jeff Bloomer, 2506; limited girl, Cheryl Eye, 1219; barebow boy, Dion Heinz, 2388; barebow girl, Stacy Minarcin, 1146. Youth division — unlimited boy, Bill Shain, Jr., 2739; unlimited girl, Janet Cockrell, 2543; limited boy, Patrick Quinn, 2730; limited girl, Janis Cilchrist, 1294; barebow boy, Scott Saxton, 1742. Cub division — unlimited boy, John Clifton, 2580; unlimited girl, Martha Seals, 1372; limited boy, Darren Meier, 2716; limited girl, Melissa Rogers, 1589; barebow boy, Mark Castle, 2087; barebow girl, Denise Menz, 1530.

IFAA world field champions — barebow male, Mike Flier, 2493; barebow female, Jo Dolive, 1252; barebow junior, Cindy Cisek, 1961; freestyle male, Richard Johnson, 2698; freestyle female, Barbara Brown, 2305; freestyle junior, M. Smith, 2077; bowhunter male, Don Proctor, 1710.

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There will also be four flights with cash and merchandise for top 10 places in each flight.

Registration fee is \$10. Total entry fee is \$50 in open and PAA divisions. Registration fee must be in the PAA office by Oct. 31. Mail to PAA, Box 7609, Flint, Michigan 48507.

McKINNEY, BUTZ WIN AT BATAVIA

Tim McKinney, with a 589, and Ann Rutz, with a 576, won their divisions at the Batavia, New York, shoot in June.

Winds up to 25 miles per hour affected shooting.

Trailing McKinney were Bill Freeman, 582, Al Lizzio, 581, and Greg Shumaker, 579. Trailing Butz were Dot Hesskamp, 563, Marilyn Nicholas, 560, and Jody Holder, 554.

Don Parker, with a 576, won the men's sportsman division; Chris Metzger, with 473, won the women's division.

HARRIS, McKINNEY WIN KOKO OPEN

In an event shortened to one-and-a-half rounds from rain, Bill Harris, with 443 won the men's championship of the Koko Open, Kokomo, Indiana. He beat Ed Rohde, who also notched 443, in a shootoff. Betty McKinney, with 422, won the women's division.

Following McKinney were Judi Webber, 420, and Dot Hesskamp, 409. Following Harris and Rohde were Tim McKinney, 442, and Hugh Shaw, 441.

CHAPMAN, EDWARDS WIN ARIZONA PAA

Bill Chapman, with 294-296/590, and Maureen Edwards, with 273-253/526, won their respective divisional titles at the 1975 Arizona Professional Archers outdoor championship. Cal Werdebaugh, with 291-295/586 and Dick Tone, with 282-285/567, were second and third men. Marion Rhodes, 267-245/512 was second to Edwards.

Other divisional winners were Tex Heinzelman, open men, 275-280/555; Betty Minnich, open women, 240-255/495; Martin Sliwinski, intermediate boys, 280-278/558; Lynette Edwards, intermediate girls, 275-260/535; Mark Vancas, amateur men, 291-289/580; Irene Lorensen, amateur women, 278-285/563.

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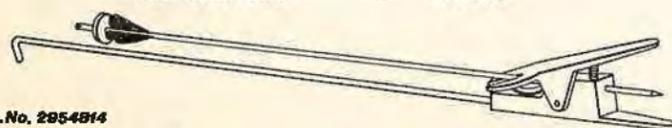
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WORLD (Continued from page 43)

to affect any scores.

The field was more of a problem. It was uneven; a Mexican shooter stumbled in a hole walking to the target and broke her wrist. The backdrop for the targets bordered on a public street, and that bothered some shooters. But on the whole, the world tournament was a fine affair, well hosted and well run.

Oh yes, the records: Women's champion Zebiniso Rustamova, USSR, 2465, beating Emma Capchenko's 2381 set in 1971; her 590 at 90 meters, and her 618 at 60 meters. Linda Myers 608 at 50 meters, beating Doreen Wilber's 587 set in 1971. Rustamova's 661 at 30 meters, breaking Nancy Myrick Crossin's 649, set in 1969.

Darrel Pace's 2548 total, 569 at 90 meters and 656 at 50 meters, plus his 328 single at 50 meters, and his 698 double at 30 meters and 354 single at that distance. Wojciech Szymanczyk's 626 at 70 meters, beating John Williams' 620.

The United States men broke their own team record of 7194, set in 1969, with a 7404 here. They also set a single FITA record of 3757, breaking the 3676 mark set by Italy. The USSR women's team established a new mark with 7252, breaking the 6907 set in 1971 by Poland. North Korea was second at 7135 with the U.S. women third at 7078.

MEN'S DIVISION	90m	70m	50m	30m	TOTAL	FINAL
Darrel Pace, USA	282	312	328	344	1266	2548
Richard McKinney, USA	287	313	328	354	1282	2548

Richard McKinney, USA	264	301	307	341	1213	
Kauko Laasonen, Fin.	272	300	304	342	1218	
Rodney Baston, USA	280	307	307	338	1232	2450

Rodney Baston, USA	263	302	309	334	1208	
Sante Spigarelli, Italy	278	288	318	346	1230	2438
Doug Brothers, USA	293	306	308	332	1239	

Sante Spigarelli, Italy	272	280	303	343	1198	2437
Doug Brothers, USA	260	298	312	333	1203	
Hirose Akira, Japan	278	299	308	341	1226	2429

Hirose Akira, Japan	273	310	300	335	1218	
Ron Lippert, Canada	256	298	312	343	1209	2427
W. Szymanczyk, Poland	261	304	299	335	1199	

Ron Lippert, Canada	276	289	313	344	1222	2421
W. Szymanczyk, Poland	258	318	302	332	1210	
Tezima Masaki, Japan	264	308	296	339	1207	2417

Tezima Masaki, Japan	255	288	294	337	1174	
WOMEN'S DIVISION	70m	60m	50m	30m	TOTAL	FINAL

Zebiniso Rustamova, USSR	296	314	299	329	1238	2465
Valentina Kovpan, USSR	294	304	297	332	1227	2465
Valentina Kovpan, USSR	279	305	301	331	1216	

Valentina Kovpan, USSR	280	305	300	329	1214	2430
Hi Han Sun, N. Korea	280	307	294	317	1198	
Hi Han Sun, N. Korea	285	306	292	320	1203	2401

Hi Han Sun, N. Korea	282	301	287	336	1206	
Min Kim Hyang, N. Korea	283	303	283	320	1189	2395
Min Kim Hyang, N. Korea	282	301	287	336	1206	

Min Kim Hyang, N. Korea	283	303	283	320	1189	2395
Linda Myers, USA	273	308	296	319	1196	
Linda Myers, USA	283	278	312	324	1197	2393

Linda Myers, USA	288	302	269	326	1185	
Irene Lorenson, USA	282	301	301	318	1202	2387
Irene Lorenson, USA	268	301	302	325	1196	

Irene Lorenson, USA	265	295	278	330	1168	2364
Wirwe Holtsmeier, USSR	271	293	269	325	1158	
Wirwe Holtsmeier, USSR	287	297	299	316	1199	2357

Wirwe Holtsmeier, USSR	266	304	266	323	1159	
Irena Szydłowska, Poland	281	298	285	331	1195	2354
Irena Szydłowska, Poland	270	305	254	321	1150	

Irena Szydłowska, Poland	279	291	287	332	1189	2339
Yung Djang Sun, N. Korea	223	261	290	315	1089	
Yung Djang Sun, N. Korea	285	315	279	330	1209	2298

Yung Djang Sun, N. Korea	261	283	282	321	1147	
Ruth Rowe, USA (15th)	259	284	269	324	1136	2283
Ruth Rowe, USA (15th)	261	283	282	321	1147	

Ruth Rowe, USA (15th)	259	284	269	324	1136	2283
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• Jean Lee Lombardo, East Longmeadow, Mass., the NAA women's champion 1948-1951 and second-place finisher in 1952, was initiated into the Archery Hall of Fame at the awards banquet. Initiated posthumously were Mrs. M. E. Howell, who was NAA women's champ 17 times between 1882 and 1907, and Dr. Paul Crouch, a long-time NAA director and archery activist for more than 40 years until his death a couple of years ago.

NATIONAL (Continued from page 45)

dence and some with not quite that much. Eight of them broke on the line Tuesday, but this was credited primarily to overdoing the efforts to pick up arrow speed through too light a string or too few strands in the string. Vic Berger said that a shooter should use at least eight reasonably thick strands on a 45-pound bow, and if a thinner strand is used you might need to go as high as 16 strands.

There were also several "V-Bar" double counter balances being used. This unit is in the shape of a "Y." It gives additional stability because it gets some of the weight out to the side of the bow and changes the vector of the reaction forces.

WOMEN'S AMATEUR	FITA	900	900	TOTAL
Irene Lorenson	1242	800	825	2867
Doreen Wilber	1190	781	807	2778

Doreen Wilber	1176	788	809	2773
Lucille Lessard, Can.	1177	774	791	2742
Linda Myers	1158	788	765	2711

Joan McDonald, Can.	1151	780	793	2724
Judy Parnham	1155	757	789	2701
Juliette Rochon, Can.	1138	762	793	2693

Juliette Rochon, Can.	1107	785	782	2674
Katherine Sarver	1061	782	778	2631
Luann Ryon				

MEN'S AMATEUR	FITA	900	900	TOTAL
Darrell Pace	1316	857	859	3032
Richard McKinney	1258	842	842	2942

Richard McKinney	1238	841	839	2918
Ed Eliason	1224	820	845	2889
Doug Brothers	1216	829	842	2887

Doug Brothers	1215	821	837	2873
Rodney Baston	1200	821	832	2853
Joel Lecker	1193	828	829	2850

Joel Lecker	1195	823	828	2846
John Pelletier, Can.	1169	833	842	2844
Glenn Daily				

John Pelletier, Can.	1195	823	828	2846
Ron Lippert, Can.	1169	833	842	2844
Mike Gerard				

Mike Gerard	1169	833	842	2844
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Patent No. 3768456

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WOMEN'S PRO	FITA	900	900	TOTAL
Judi Webber	1115	795	801	2711
Ann Hoyt	1045	743	769	2557
Linda Marten	1040	745	762	2547

Ann Hoyt	1232	837	854	2923
James McKinney	1196	822	827	2845
Bill Bednar	1162	832	851	2845

MEN'S PRO	FITA	900	900	TOTAL
John Williams	1232	837	854	2923
James McKinney	1196	822	827	2845
Bill Bednar	1162	832	851	2845

INTERMEDIATE GIRLS	FITA	900	900	TOTAL
Sandra Van Kilsdonk	1187	783	811	2781
Jodi Crowl	1154	768	761	2683
Lynette Edwards	1114	757	762	2633

Lynette Edwards	1096	755	775	2626
Carole Cheuvront	1058	752	790	2600
Kathleen Grondin	1046	746	772	2554

INTERMEDIATE BOYS	FITA	900	900	TOTAL
Richard Bednar	1211	841	842	2894
Tony Reamer	1170	796	796	2762
Kevin Clark	1120	770	828	2718

Kevin Clark	1111	775	817	2703
Pete Weaver	1067	808	789	2664
Bert Majetic, Jr.	1094	758	777	2629

JUNIOR GIRLS	FITA	900	900	TOTAL
Susan King	1215	829	832	2876
Robin Wools	1109	759	821	2689
Kathy Daniel	1097	776	807	2680

Kathy Daniel	1282	859	849	2990
Tim Weaver	1217	820	815	2852
Thomas Stevenson, Jr.	1176	802	816	2794

JUNIOR BOYS	FITA	900	900	TOTAL
Tim Weaver	1282	859	849	2990
Thomas Stevenson, Jr.	1217	820	815	2852
Gary Hagler	1176	802	816	2794

CADET GIRLS	FITA	900	900	TOTAL
Sandra King	1189	772	789	2750
Vickie LeBlanc	1087	739	744	2570
Terri Pesho	1030	700	706	2435

CADET BOYS	FITA	900	900	TOTAL
Marty Sliwinski	1290	851	848	2989
Mike Wrocklage	1120	756	761	2637
Lonny King	1054	751	720	2525

CROSSBOW MEN	FITA	900	900	TOTAL
Marty Sliwinski	1290	851</		

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NEW KANSAS DEER RECORD

Robert Brock of Goodland, Kansas, set a new bowhunting deer record for that state, taking a non-typical mule deer in Sherman county during the 1974 archery season. The deer scored 224-6/8 points, breaking the long-standing record set in 1966 by Ralph Stum of Ness City. Stum's deer was scored at 211-6/8.

OPERATION WHITETAIL — BOWHUNTING RESERVE

Operation Whitetail, a non-profit organization sponsored by the Sportsmen's Clubs of Texas, offers 10,000 acres of woodland to bowhunters only during the 1975-76 season. The land is separated into four pastures including areas for hunting from blinds only and areas for stalking or blinds.

A special deer season from October 1 through October 31 may be hunted by reservation only. Regular deer season is from November 15 through January 4, no reservation required. Hunting for other animals (rams, sheep, goats, hogs, etc.) is open October 1 through March 31 by reservation only. The daily fee is \$15, with special rates available for longer hunts. There is no replacement fee on deer.

Over 100 deer were harvested through Operation Whitetail in 1973 and 1974. Including deer, rams, goats and hogs, the past three-year kill ratio is 22.2 percent. For more information or reservations, write: Paul Ross, SCOT Project Superintendent, Rt. 1, Box 47-A, Bronson, Tex. 75930; or call: 713/584-2248.

GORDON IN NEW LOCATION

Gordon Plastics, maker of Bo-Tuff and Glashafts, has moved to a new plant of 14,000 square feet with 1,800 square feet of office and laboratory space. Their new address is Gordon Plastics, Inc., 2872 S. Santa Fe Ave., Vista, Cal. 92083. One of the new things to come out of their plant is an all new concept in arrow shafts — the glass-carbon arrow. Lighter than aluminum and tough as fiberglass, it is reasonably priced.

CANADIAN CHALLENGE

The Archers of Caledon, Toronto, have invited archers around the world to participate in a mail tournament. The round to be shot is the Canadian 1200, which is six arrows per end on a 122 cm face, 10-ring scoring. For men, it is five ends at 70 meters, five ends at 60 meters, five ends at 50 meters and five ends at 40 meters. For women and juniors, the distances are 60 meters, 50 meters, 40 meters and 30 meters.

Registration fee is \$1.00 Canadian currency payable by international money order to the Archers of Caledon. Money must be accompanied by signed and witnessed score cards and

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received no later than Nov. 15. Prizes will be for first through third places in men, women, junior and husband/wife divisions. A commemorative plaque will go to the club with the most participants.

Send your entries to Mrs. Diana Johnstone, Tournament Director, 55 Tedder St., Toronto, Ontario, Canada M6M 4X2.

MILE HIGH OPEN

The Golden Mesa Recreational Ranch in Golden, Col., will host the Mile High Open Tournament October 25 and 26. The tournament, which is sanctioned by the NFAA pro division, will feature a 600 Vegas Round with limited and unlimited divisions and a guaranteed purse of \$3,000. Entry fees are: pro, \$35; unlimited, \$25; amateur, \$15; cub, \$5. For more information, write: Mile High Open, 19000 W. 58th Ave., Golden, Colo. 80401; or call, 303/279-4546.

WILD TURKEY BUCKLE

An authentic Austin Nichols collectors belt buckle is being offered through the National Wild Turkey Federation, a non-profit conservation organization. Made for 1-3/4" belts, each buckle weighs six ounces. Specify brass or pewter finish. Five dollars each or two for \$9 (add 50 cents postage and handling for each item). Order from: National Wild Turkey Federation, Dept. AW, P.O. Box 467, Edgefield, S.C. 29824. All proceeds used to manage the federation's wild turkey management and restoration areas.

HERTER'S SPORTSMANS CATALOG

The 1976 edition contains many new items as well as thousands of old standards for the outdoor enthusiast: hunting, fishing, archery, camping, backpacking, clothing, reloading and specialty items. Send \$1.00 (refunded on first \$10.00 order) to Herter's, Inc., Dept. AW, Waseca, Minn. 56093.



ULTRA PRODUCTS CATALOG

Ultra Products "Spirit of '76" catalog is now available free. It has 68 pages of bowhunting accessories, target accessories, general outdoor and camping items, plus tips on tackle setup and basic bowhunting techniques. You can get a copy by writing to Ultra Products, Dept. AW, Box 100, Fairfield, Ill. 62837.

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"HUNT COLORADO" WINNER

Jack C. Pigman, Sr. of Elyria, Ohio, has won the "Hunt Colorado" contest sponsored by Robin Hood Archery, Inc. of Montclair, N.J. Pigman will enjoy a free hunt in Colorado with John Lamicq, Jr., one of the top bowhunting guides in the country. Also assisting in sponsorship of the contest was John Lamicq Guide Service, Grand Junction, Col., and Bowhunter Deer Lure, Canajoharie, N.Y.

PENNSYLVANIA BOWHUNTERS FORM PROFESSIONAL SOCIETY

A group of Pennsylvania bowhunters have formed a pro-hunting organization known as the "Pennsylvania Professional Bowhunters' Society" (PPBS). This group intends to combat anti-hunting pressure by attempting to upgrade the image of the bowhunter. Among other things, the PPBS would like a mandatory safety program including an archery efficiency test to be given to all bowhunters. For information and membership application, contact: Bob Russin, Jr., Public Relations, 226 Liberty St., Girard, Penn. 16417; Ed Gross, Secretary-Treasurer, R.D. #1, West Springfield, Penn. 16443; Dave Reynolds, Membership Chairman, 3160 Norcross Rd., Erie, Penn. 16510.

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1008. BOWHUNTER'S DIGEST. C. R. Leam. Carries the reader progressively from basics through proven techniques and equipment used by today's foremost bowhunters. Success secrets, several chapters on arrows. Camouflage and fashions for field. Bowfishing. Bowhunting associations, surveys, safety. Manufacturer addresses. 288 pp., illus. \$6.95

1010. NAA INSTRUCTOR'S MANUAL. By Patricia Baier, Julia Bowers, C.R. Fowkes, Sherwood Schoch. Edited by Ruth Rowe. A ton of knowledge covers step-by-step instructions, safety, bracing, equipment, problem corrections, archery games, bow tuning, coaching, tournament management, publicity, clinics, more. 141 pp., illus. \$10.00

1011. NAA — THE ARCHER'S HANDBOOK, 4th Edition. Contains NAA constitution, bylaws, rules and regulations for field, target, indoor clout and flight shooting, instructions of laying field course, Olympic rules and more. 108 pp., illus. paper, \$3.00

1014. TARGET ARCHERY. Margaret L. Klann. Assists the preparation of teachers and coaches in archery. Helps target archers improve personal skill and understanding. Suitable for beginner or advanced. Target techniques, equipment, common shooting problems, rules and scoring, scientific aspects, exer-

cises, teaching progressions. 162 pp., illus. softbound, \$3.50

1015. NATIVE AMERICAN BOWS, THEIR TYPES AND RELATIONSHIPS. T. M. Hamilton. Detailed systematic study of bows used by Western Indians and Eskimos. Author, archaeological researcher, tells why bowmakers wrought as they did. Includes info on self-bow, reinforced, composite and double-curved bows. 148 pp., illus. casebound, \$10.00

8012. WHITTLIN', WHISTLES AND THINGAMAJIGS. Harlan G. Metcalf. A "do-it-yourself" primer tells you how to make and use wood bows and arrows (complete with patterns), boomerangs, throwing slings, blowpipes, javelins, spear-throwers, whip-darts and slingshots. How to make and use everything you wanted to try as a kid, but never did. 190 pp., illus. \$10.00

1025. ARROWS AGAINST STEEL: The History of the Bow. Vic Hurlley. An overview of how the bow has affected human history from the bow's African origin c. 7000 B.C. Shows how it aroused men into flight, into exploration and exchanges of ideas. 238 pp., \$5.95

1026. EVERYTHING I KNOW ABOUT BUCKS WITH A BOW. Bob Kirschner. Author, who has taken 12 bucks out of 16 years of hunting, believes success can be achieved through better understanding of the outdoors, animal habits and characteristics with different weather conditions, proper scouting, selecting right equipment. Gets into skinning, meat preparation and storage. Book designed to be taken into the field. 104 pp., illus. paper, \$2.20

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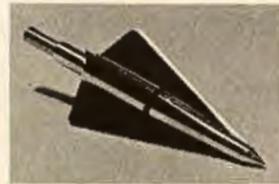
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The Stag tree seat is a strong metal unit with 360-degree swivel seat and foot support all the way around. Collapsible and compact for easy carrying. Weighs 16 pounds. Locks to tree with chain. Suggested retail is \$69.95. A smaller model, the Little Buck, weighs 12 pounds, retails for \$49.95. Cat Claw climbing steps, recoverable and reusable, also available. Full info from Stag Mfg., Inc., Dept. AW, P.O. Box 45915, Houston, Texas 77045.



PROTECTO COMPOUND CADDY

Protect your compound bow, arrows, sight, quiver, other accessories from damage with ABS high-impact plastic Compound Caddy from Protecto Plastics. Case measures 15x56x6 inches. Outside has mar-proof finish. Key locks it for protection. Foam-type padding inside keeps all equipment in place. JTB Junior Case is for women, juniors and male archers using bows with shorter draw. Easy to handle, measuring 12x29x6 inches. Contact Protecto Plastics, Dept. AW, P.O. Box 68, 201 Alpha Road, Wind Gap, Pa. 18091.

TIEFEL MINI STAND

The Tiefel Mini Tree Stand is 19 inches by 17 inches by 14 inches, including adjustable-height seat. Tubular aluminum framing, loop chain fastening system. Plywood stand. Side support arms give foot brace for security when you shoot. Suggested retail is \$45.00. Full info available from Tiefel's Tree Stands, Dept. AW, 87 Fillmore St., Rochester, N.Y. 14611.



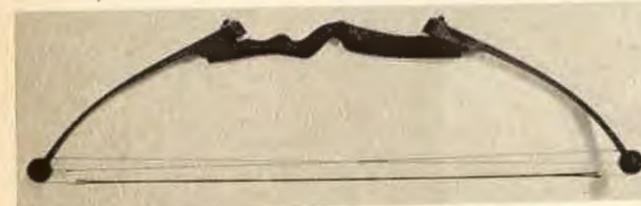
DODD RELEASE

Two special alloys of tool steel, heat treated to different hardnesses, are combined to make the Dodd Release one which should last forever. Simple to use. Push into bow string and it latches. After shooting, the catch is held open by a stainless steel spring. Should it bounce back closed, pull trigger and the catch opens. Trigger travel and tension fully adjustable. Cable handle. Pull test is 400 pounds. Unconditionally guaranteed. Contact Dodd Archery, Dept. AW, Box 72, Newton, Kansas 67114.



BONNIE BOWMAN TWO-PIECE BOW QUIVER

The "PAT'S 7" two-piece bow quiver holds seven arrows. Rubber arrow holding unit is specially molded from a rubber compound that has a "memory," so can accommodate arrows from 1816 aluminum to 11/32" woods, holding firmly but letting you remove them easily. Broadhead cover is of tough ABS material. Quiver has two-year guarantee; fits all Jennings compounds including metal hunters, "S" handles, Model T, all PSE compounds, Browning, Astro, Martin Cougar. Designed to fit left or right hand bows with arrows pointing up or down, whichever you prefer. Suggested list price below \$15. Dealer/distributor inquiries invited. Full info available from Bonnie Bowman Archery, 5105 East 12th St., Oakland, Cal. 94601.



RAMBOLAY HUNTER COMPOUND

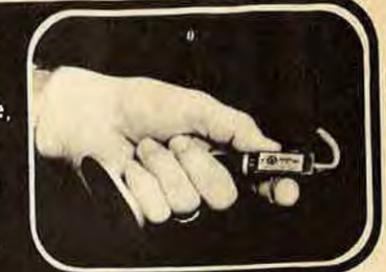
Selling for less than \$170, this new compound hunting bow weighs just under four pounds, measures 45 inches axle to axle, and comes with a 15-pound draw weight adjustment (you order your draw length). Handle and limbs finished with black or green "wrinkle" paint. Bow has a 5 1/2-inch sight window and can be ordered with stabilizer bushing, drilled for sight mount and adjustable rest hole. For more information, write Rocky Mountain Archery Manufacturing Co., Dept. AW, P.O. Box 208, Rangely, Colo. 81648.

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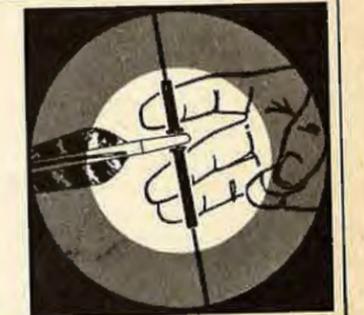
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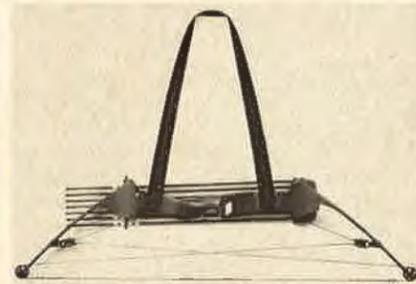
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ON THE MARKET (Continued from page 81)



BINGHAM TARGET COMPOUND

This bow features exotic wood riser with a special, glass laminated spine; white glass on limbs. Comes with stabilizer and carrying case, equipped with Berger Button and Flip Rest. In 10-pound increments of draw weight, up to 32 inches of draw length. Right and left hand. Suggested retail \$279.95, but will be available during a special introductory period for \$223.50. Full info available from Bingham Archery, Dept. AW, 3013, Ogden, Utah 84403.



KOLPIN BOW SLING

Wide nylon web strap with double snaps at each end permits easier carrying of heavy compound bows, etc. Suggested retail \$4.95. Full info available from Kolpin Manufacturing, Dept. AW, P.O. Box 231, Berlin, Wis. 54923.



WILSON BROS. ARROW REST

The new Arrow Flight Control rest is available only on Black Widow bows, factory installed. Rest moves in and out with plunger for better arrow flight. Three sizes of arrow support vanes, right or left hand. Full info available from Wilson Brothers, Dept. AW, Rt. 16, Box 200, Springfield, Mo. 65807.



HUNTER II REST

Designed for use with or without cushion plunger. Positive vertical and horizontal locking adjustments. Rest and side support gives with the shot for optimum arrow flight. Full info from Golden Key Archery, Dept. AW, 1851 S. Orange Ave., Monterey Park, Cal. 91754.

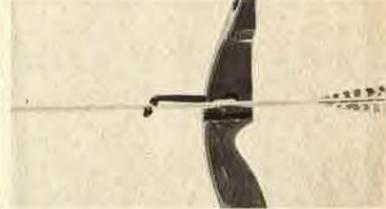
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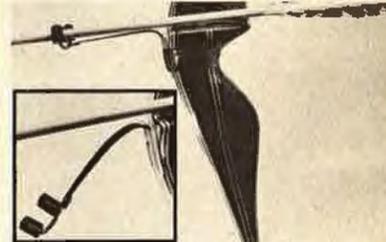
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PSE PROFICIENCY

A more sophisticated model than the Pacer, the Proficiency offers all the same desirable features, plus Full Idler Wheel System for greater stored energy and efficiency, and new PSE Speed Brackets for superior velocity. Improved design includes the same one-piece, die-cast handle as our Top-of-the-Line Citation, with integrally molded limb sockets for precise limb alignment, and the innovative pivoting speed-bracket E-Wheel adjustment and quick, simple cable replacement. Available in draw lengths of 26, 27, 28, 29, 30, & 31", and draw weights from 35 to 70 lbs., in 10 lb. weight ranges. See your dealer or write for our new color catalog for complete details.

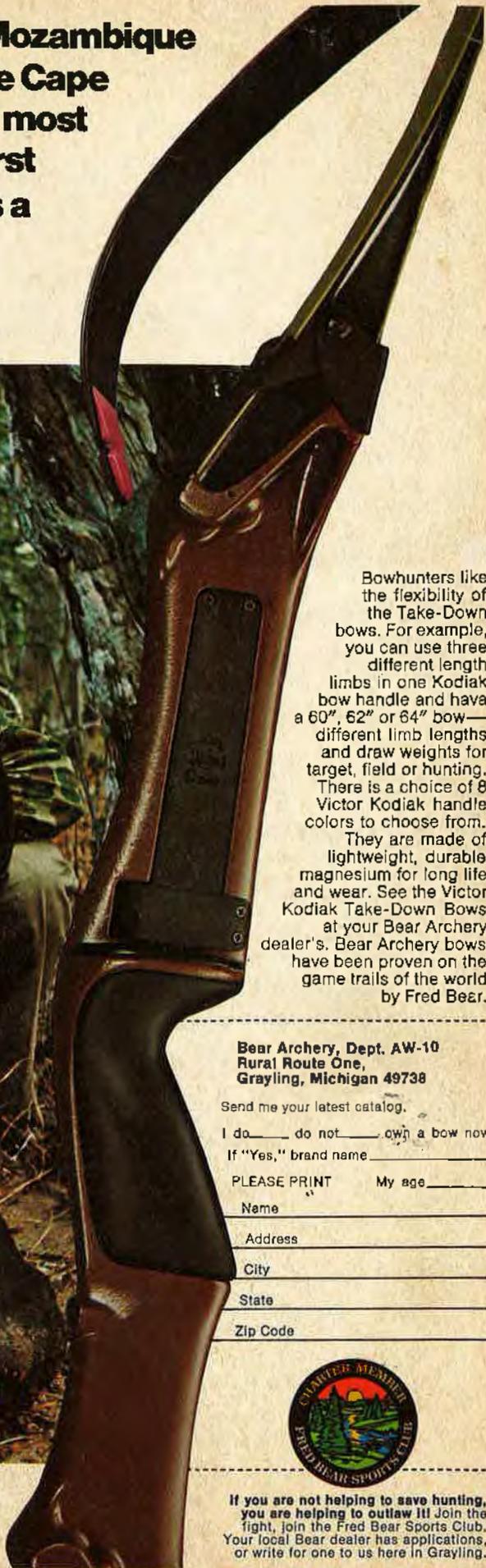
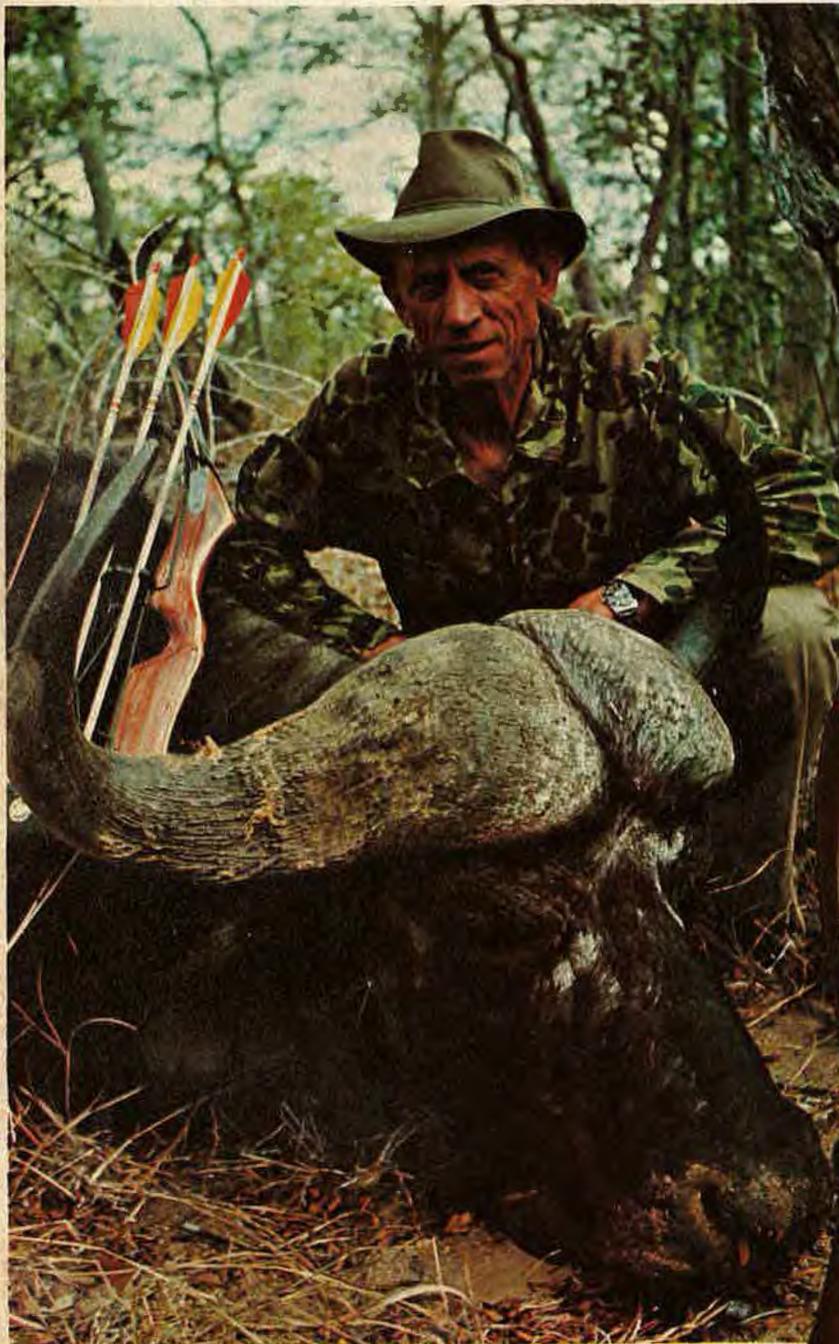


PRECISION SHOOTING EQUIPMENT

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