

FOUR OF N2DE's PADDLE REVIEW ARTICLES

The Anatomy of Paddles

[Ulrich H. Steinberg \(N2DE\)](#) on June 9, 2004

The Anatomy of Paddles

WARNING: Don't read this unless you're a key nut or are seriously infected with the paddle bug (bacillus iambicus)! You may also have to show a little patience since this article contains many photos and may take a while to load ...

Since my [last article on eHam](#), where I outed myself as just that, I have received several emails asking in essence in so many words "what do you think makes a great key?" This is a difficult question because the answer is necessarily subjective, but fortunately there are also some criteria that can be objectively established. Since dual-lever paddles are probably the most popular type of key today, let me attempt a partial answer for "squeeze" keys here.

Let me say something up front: what I am discussing here are some finer points of paddle engineering, and some of the resulting characteristics will only be detected by the most sensitive finger tips, and they matter only at higher speeds. Any old paddle will do if you operate with large contact spacing and a high return force and you really slap it around. That, of course, imposes a natural limit on your speed, but paddles for that type of operation also tend to put less strain on your wallet. (The reverse is not true: spending a lot of money does not necessarily buy you a great paddle) For some of the paddles I'm showing here I would never dare tell my wife how much I paid, though ...

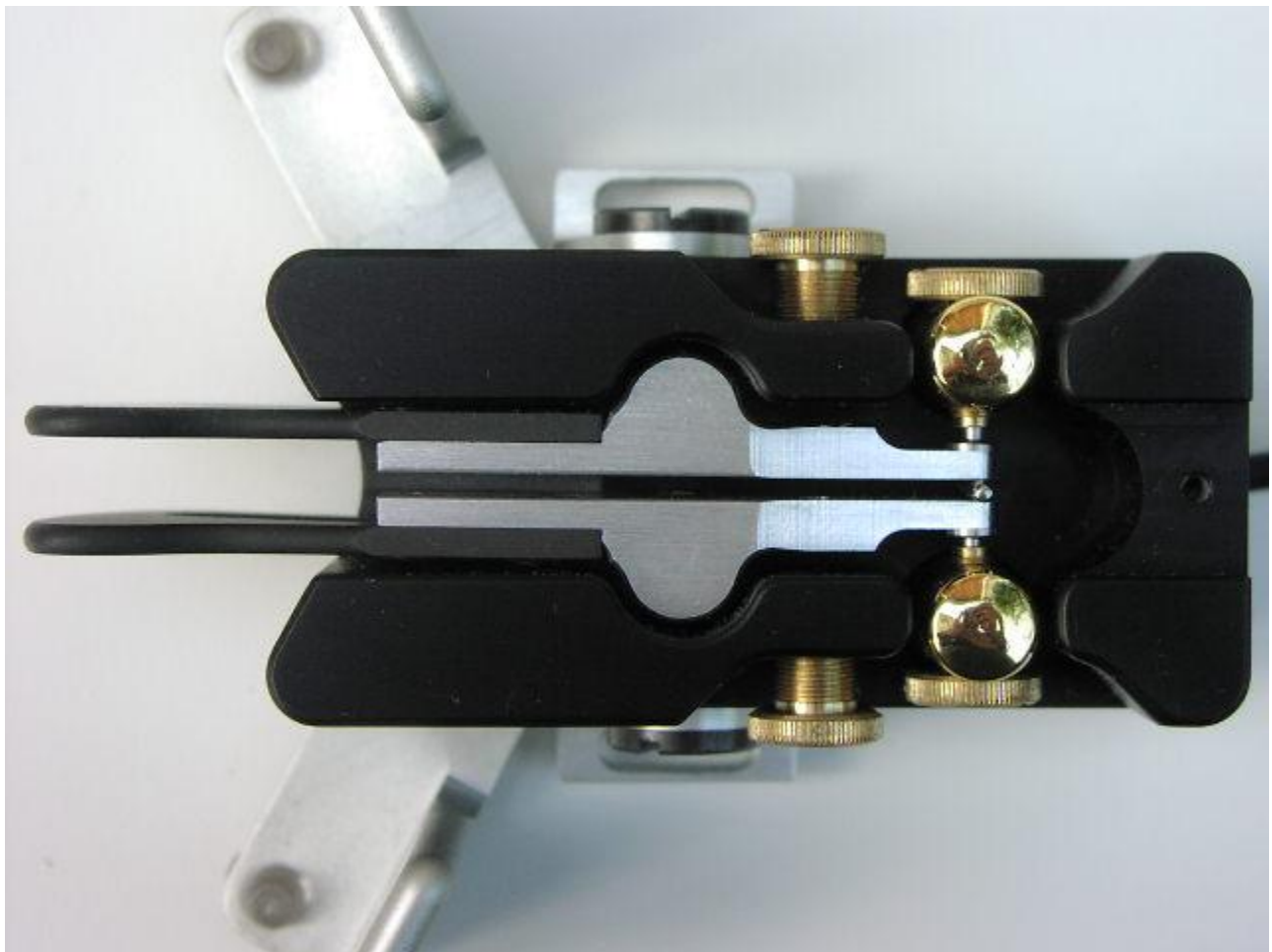
A modern iambic paddle is a compromise between several contradictory requirements, and every design tries to find its particular balance. A balanced mix of all elements is the secret of the truly great paddles. There are paddles out there where every single design element taken in isolation is not top notch, but the combination makes the result world class. On the other hand, it usually doesn't help to have one outstanding element, say the best possible bearings, if the other elements don't complement it and let everything live up to its full potential.

What you want in a iambic key are agility, perfect repeatability, excellent tactile feedback, precise adjustments of forces and geometry, zero contact closing resistance, insensitivity to temperature changes and mechanical shock, mechanical robustness, corrosion resistance, a few more points that I keep forgetting, and everything at a price next to nothing. The target price is important - as much as we key nuts are above such petty concerns - because it forces the maker to compromise or totally ignore some of these requirements. So let's take a look at some of the better paddles that I own, and find out how they did it.

Agility is largely a result of the bearings and the effective moving mass or, more precisely, the angular momentum of the arms.

The smaller the angular momentum of the arms the easier it is to accelerate them and to return them back to their original position. Also, lighter arms are usually less prone to bounce and vibration, which actually becomes a problem with some constructions (although you will rarely recognize it as such if you don't know what the effect feels like). You can reduce the mass by either using light-weight material or by reducing the dimensions of the arms, or a combination of both. If the paddle uses magnets for the return force (more about that later) it is important to mount them close to the pivot if you want to keep the angular momentum small.

The Begali Traveler, e.g., uses a light-weight alloy for mass reduction and mounts the magnets as close as possible to the pivot:



The WBL V22 is taking size reduction very far - the arms are only 1.5 inches long



The Frattini Iambic is a picture perfect example of short light-weight arms and magnets mounted close to the pivot:



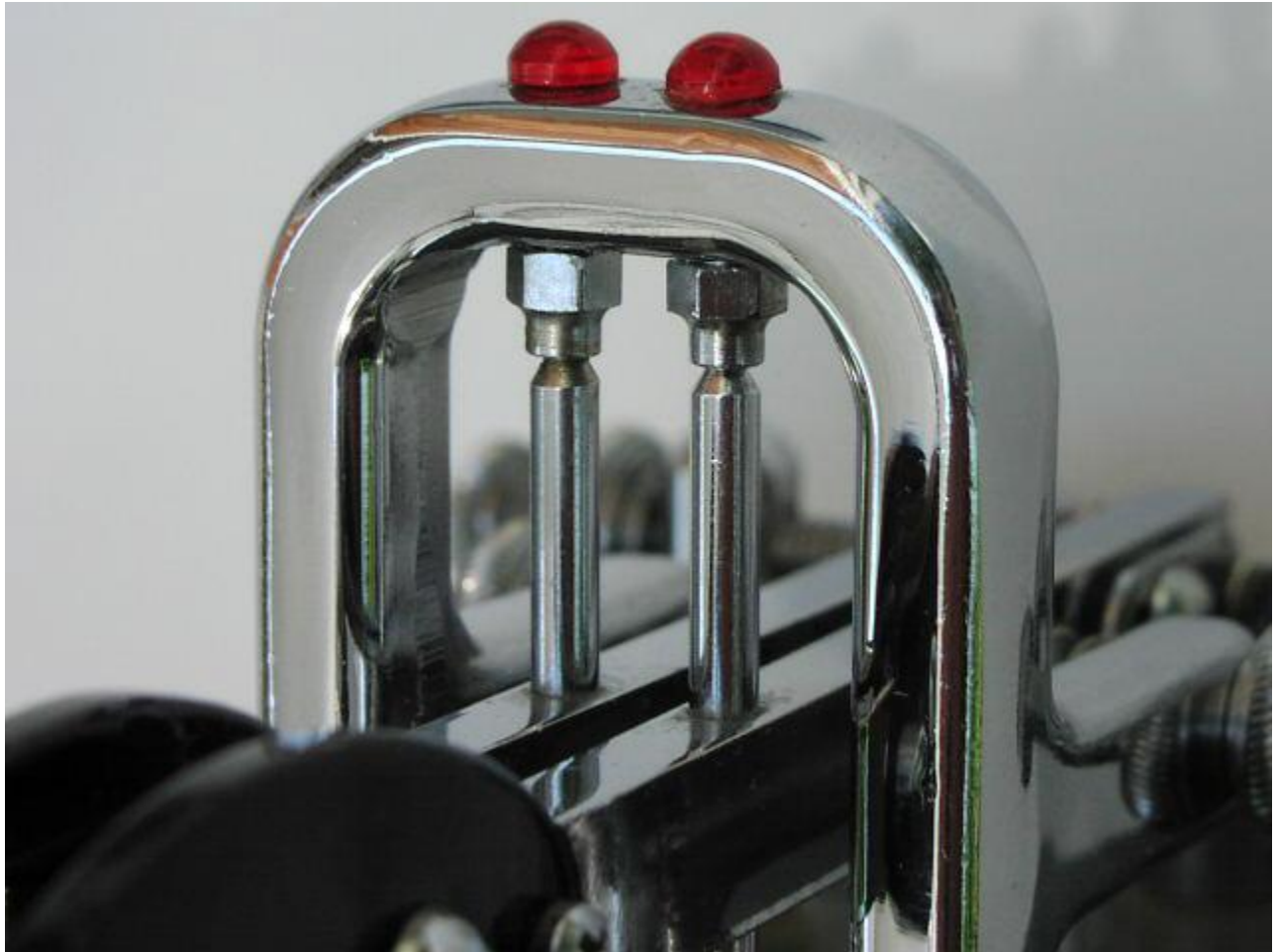
None of the very best paddles that I know have really massive arms, and reducing the angular momentum is probably one of the most important design elements in my experience. The ***** (I don't want to get hate mail ...) and its various offspring have massive arms, and that is one of the reasons why they eventually migrated from my desk to my showcase ...

Of course the best light-weight arms don't help if your paddle has poor **bearings**. The purpose of bearings is not only to facilitate rotation of the arms with minimal friction (after all, the arms rotate only by a tiny angle), but also to provide axial stability so that the levers move only horizontally and return to precisely the same position every time without wobbling around.

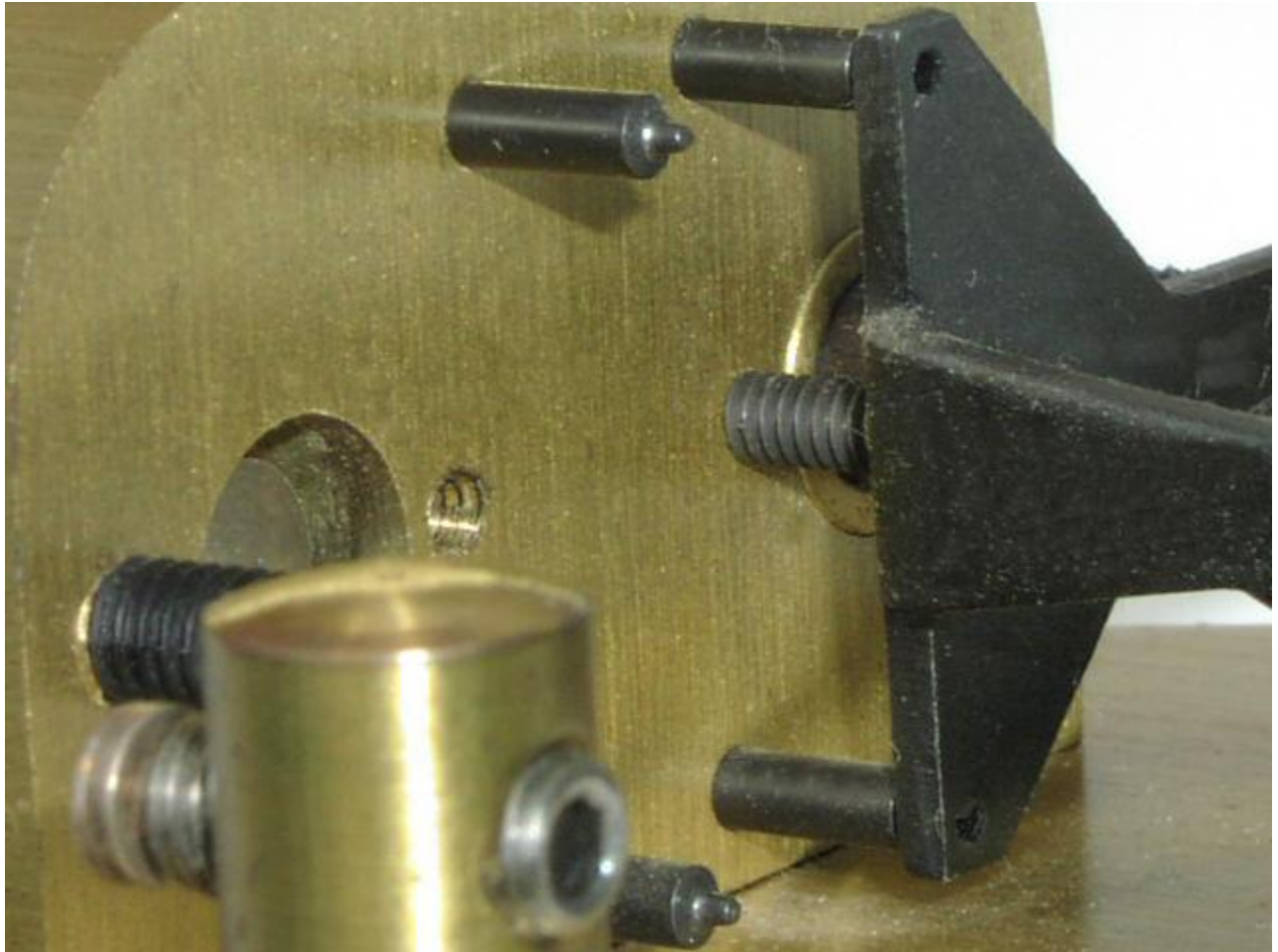
The simplest bearing, used mostly in home-brew projects, is a sleeve bearing: a hole drilled through the arm or a short tube welded to the arm that rotates around a steel pin. This is easily done without professional tools, but it is obviously far from the ideal frictionless bearing and not a solution that you would consider for a precision instrument.

The adjustable trunnion bearing is used, e.g., by Vibroplex, Schurr, Frattini and many other paddles. It is relatively simple and low-cost, but it can be sensitive to adjustments and temperature changes: tighten it a little too much and you end up with unacceptable friction, loosen it a bit and the levers start wobbling around. Only the very best makers have been able to make this work really well, and how they do it is part of their black magic.

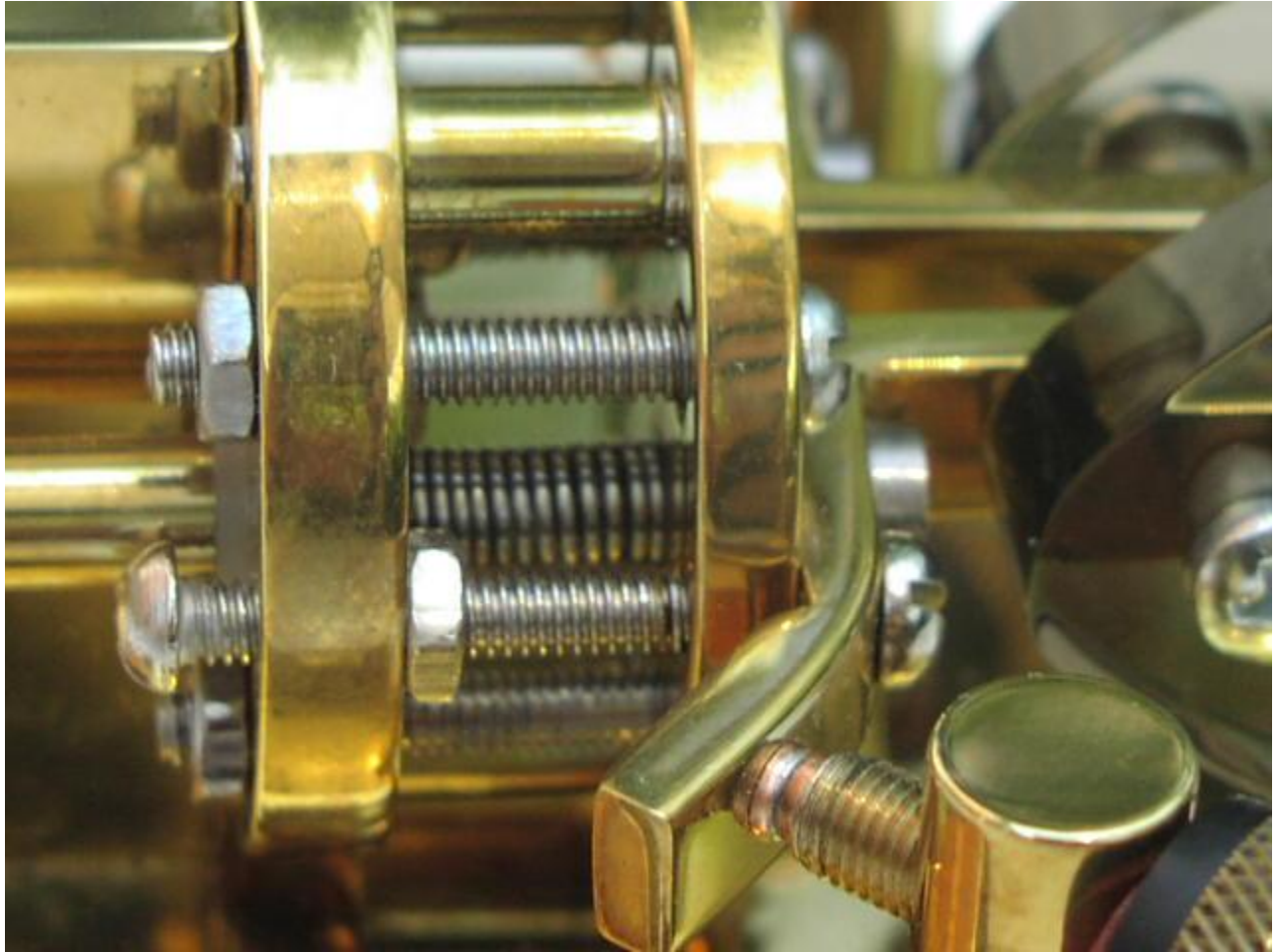
The classical trunnion bearings of the Vibroplex provide instant visual recognition:



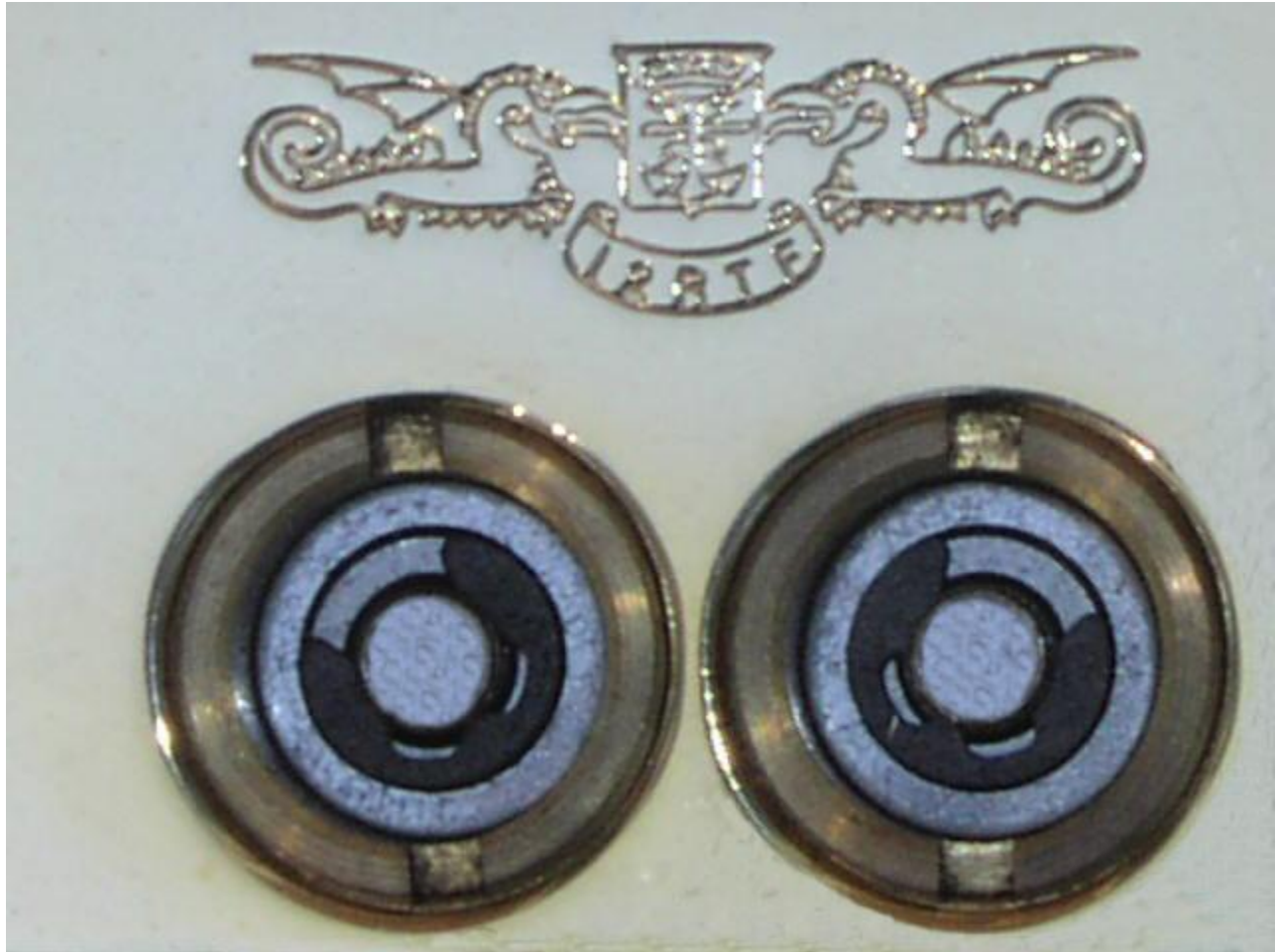
The frictionless two-point suspension is used, e.g., in the Vibroplex Racers, the ubiquitous Bencher, the G4ZPY. This construction is best visible in a close up of the Hamco Scotia (seems it has grown some moss in the past 25 years...):



It is practically frictionless, but the return force for the arms is also used to hold them in place. This implies that, as you reduce the return force, the whole mechanism becomes less stable. The ***** (the censor, again), e.g., requires a sizable tension if you don't want it to fly apart when you bump it. The G4ZPY and others use additional screws to reduce this problem, but they are not as robust as other designs. However, the G4ZPY sure looks like an impressive piece of machinery with all these extra screws:



Sealed ball bearings are typical for many modern high-end paddles. They provide near-frictionless rotation and excellent axial stability:



One paddle on the market employs flex bearings, a type of frictionless bearing for small rotational angles that uses a special torsion spring. In theory they are ideal, although designed for applications that are far beyond the demands of a paddle, but their cost (more than \$100 for a paddle) makes them prohibitive for most designs. And even the most sensitive finger tips at the highest possible speeds could probably not detect a difference compared to high-quality sealed bearings that cost only a few dollars (I have to admit that I could never compare it personally, although I tried to get one). But again, this is one of the elements where a manufacturer has to decide how to spread the cost budget over everything that constitutes a paddle.

The **paddle geometry** has a major influence on tactile feedback and on temperature sensitivity. The key parameter is the leverage ratio, i.e., the distance between your finger tips and the pivot compared to the distance from the contacts to the pivot. Generally a ratio not too far off from 1:1 seems advantageous, which means that the contacts travel about the same distance as your fingers. If the finger side is much longer then a small variation in the contact gap, e.g. due to temperature variation or mechanical changes, translates into a much bigger variation at the finger side. Such a paddle has to be adjusted frequently, and if it has coarse adjustment screws you have

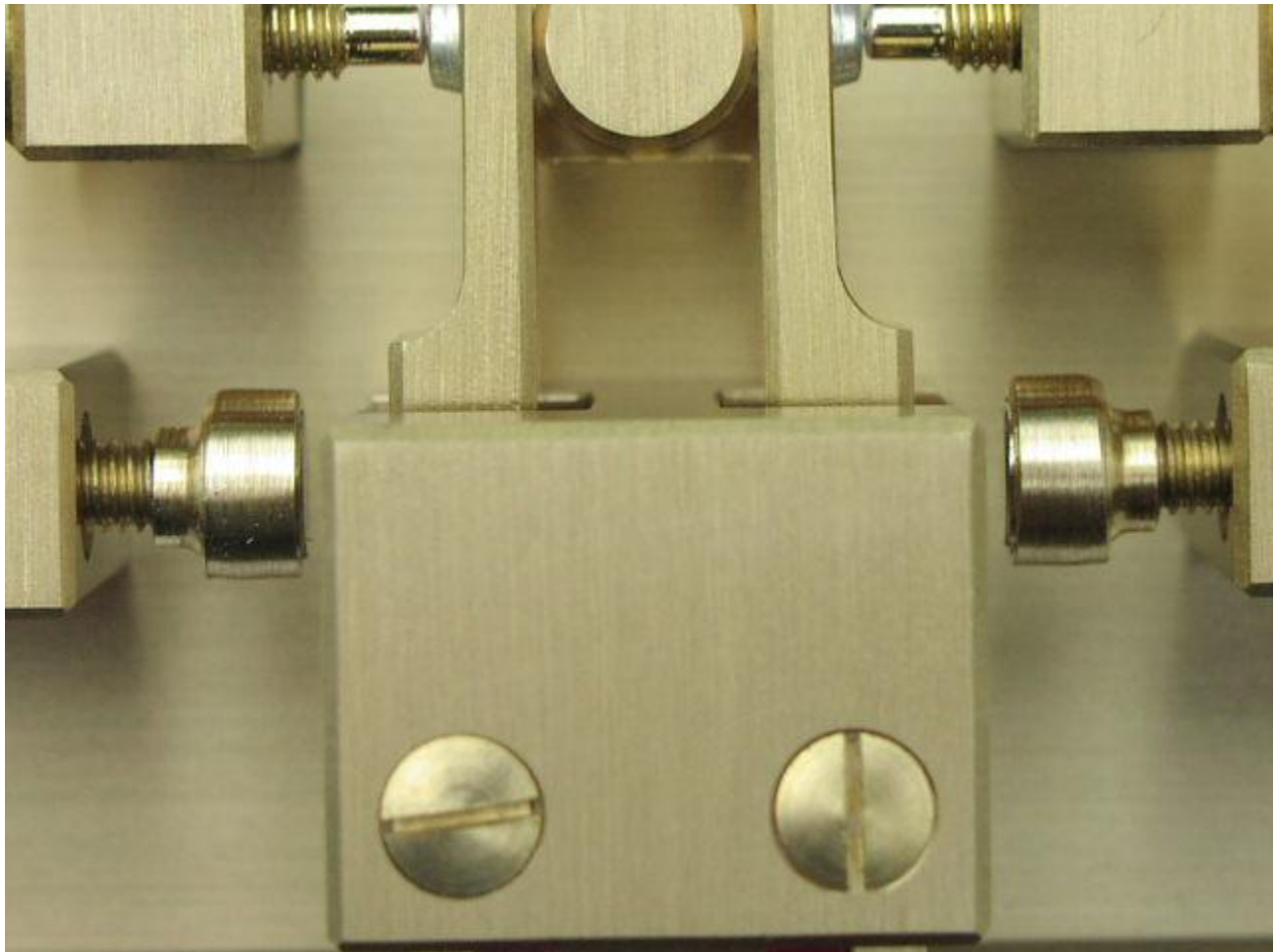
the perfect recipe for a paddle that you can never seem to adjust right for any length of time. (Let me not show examples of that. They are abundant and can be found in all price ranges ...) The WBL V22, shown further up, maintains the ideal leverage ratio despite the diminutive size of the mechanism - made possible by the vertical arrangement.

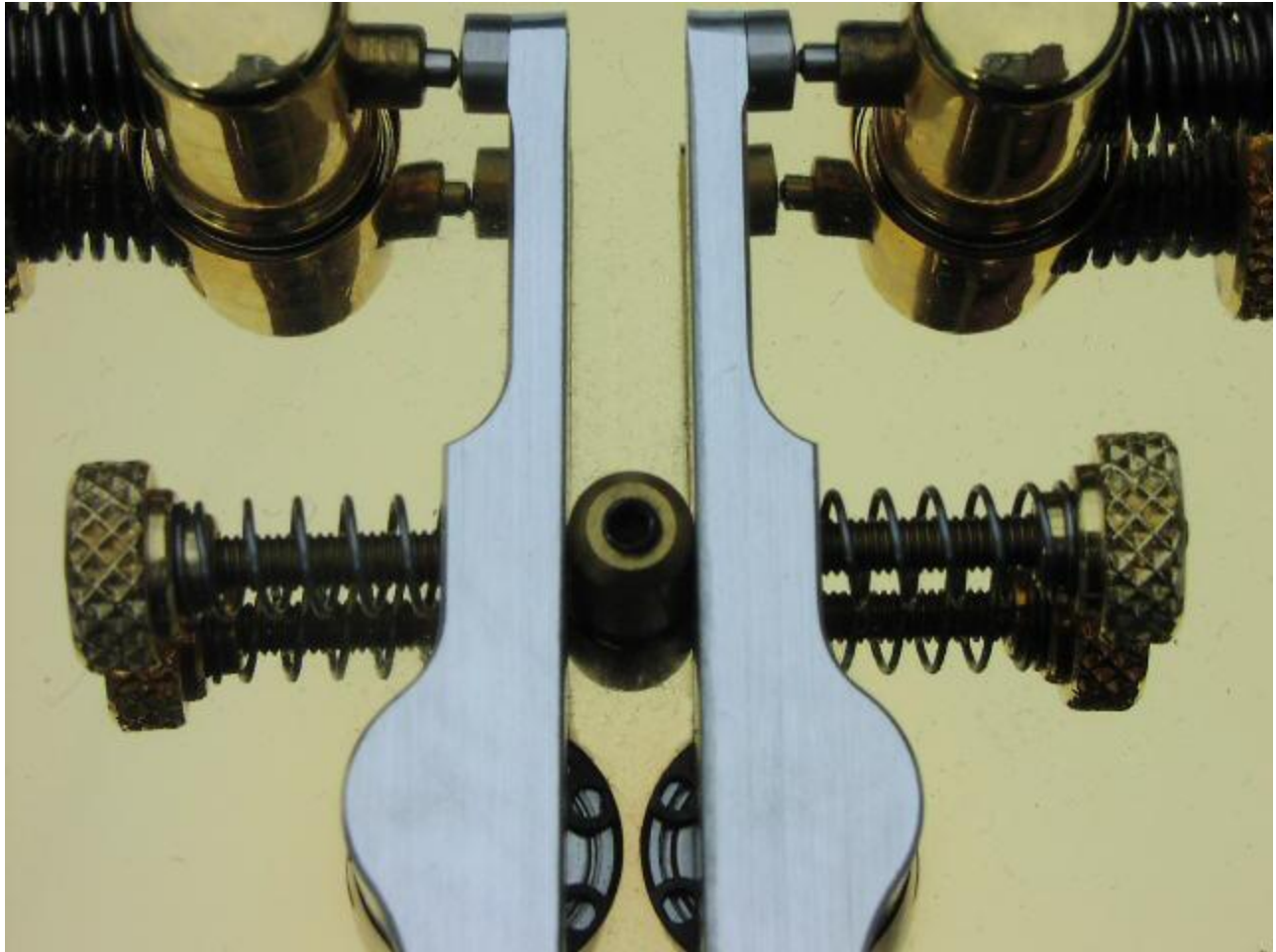
The **finger pieces** are your human interface and, not surprisingly, they come in every imaginable shape and material. Since they are located at one end of the lever they make a large contribution to the angular momentum - so a light-weight material is important. Usually you'll find plastic or an aluminum alloy, but also wood and ivory and other materials have been used. The finger pieces should be fairly rigid; otherwise you get a "mushy" feeling, but some operators prefer a certain amount of flex over perfect rigidity. Here's a collection of finger pieces from some of my paddles:



Perfect repeatability (meaning the levers return exactly to the same position and require the same force every time) requires a solid and near-frictionless suspension of the arms and a means to create a return force of unvarying characteristic. Springs are used in many paddles for the return force, but for very light settings, which many operators prefer for high speed, it is easier to create a finely adjustable return force that doesn't change over time by using magnets. If a paddle uses springs they should be relatively long and weak so that they have to be compressed already

a little bit for the lightest return force. If magnets are mounted on the levers, they will increase the angular momentum while springs do not. You can reduce this effect by using very small strong magnets and mount them close to the pivot, as shown in some good examples above. The Hamco Scotia and its modern incarnation, the Vibroplex Square Racer and Brass Racer actually use a ferromagnetic material for the arms, so no extra magnet on the arm itself is required. Many high-end paddles these days use magnets (and I personally prefer them), but there are some notable exceptions like the Schurr, or the Jones, or the WBL. Since your thumb and your index finger have different strength and sensitivity, it is an advantage if you can set the return force for both sides independently. The next two photos show the typical use of springs and magnets in two excellent paddles.





Contacts should have low residual resistance, resist corrosion, and the path to ground should be perfect. Many paddles use silver contacts which have low resistance but corrode easily, the Begali's use a corrosion resistant alloy, and a few paddles use the best (and most expensive) solution: gold contacts. Also important, and often overlooked, is how the ground connection is made - after all the paddle arms are moving but they should represent perfect ground. Hoping that the current just flows to ground through your bearings without much resistance may be an engineering shortcut. If you look at the close-up of the V22 again you'll see the thin wires that ground the arms. The Jones Iambic uses heavy-duty ground straps (you can also see the open ball bearings):

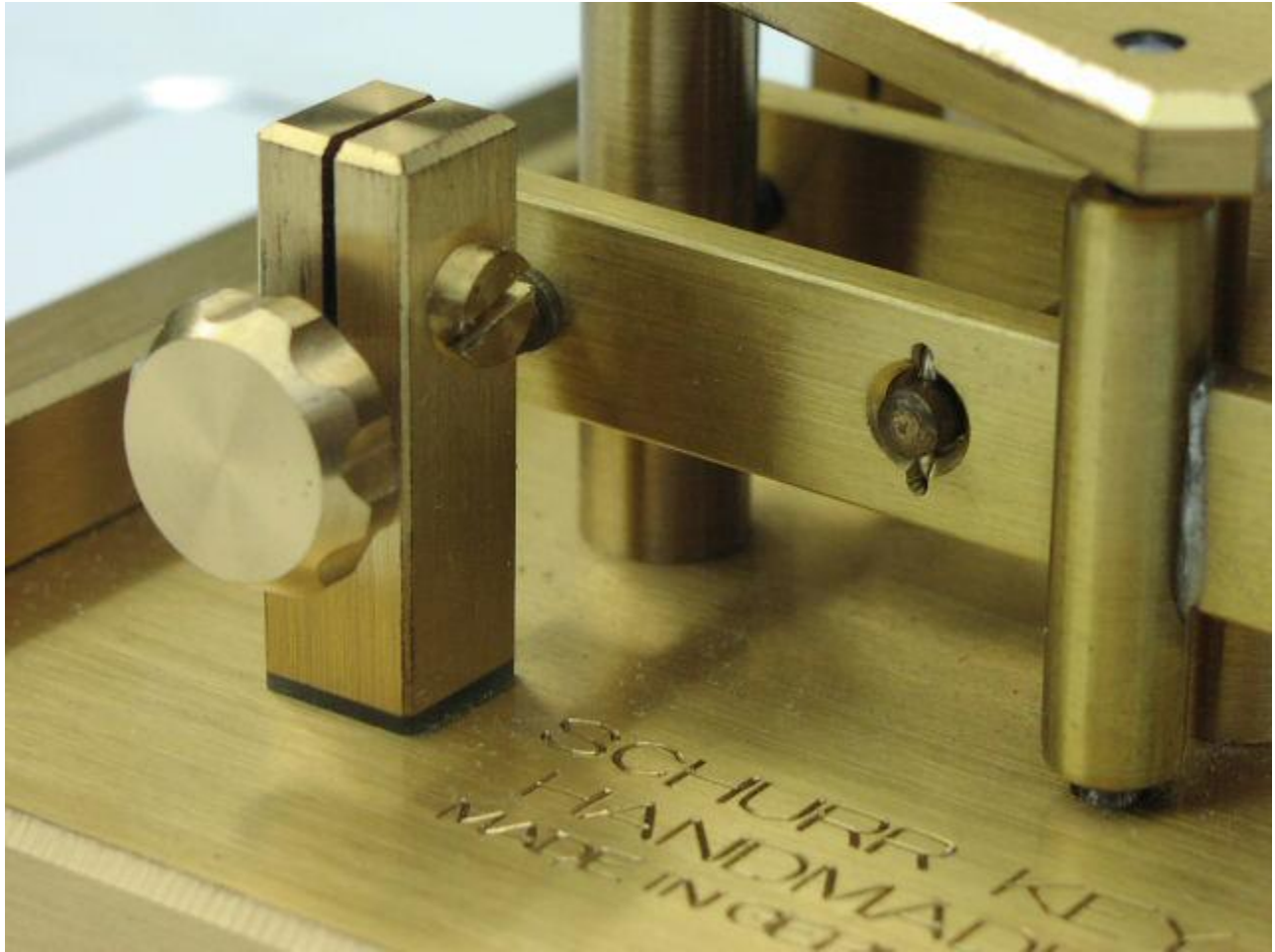


The Begali's employ an invisible approach, using bronze springs that are hidden in the bearing block.

Adjustments: There are several elements you want to be able to adjust in a paddle. Contact spacing and return force can be adjusted in all quality paddles. Of critical importance is how fine an adjustment can be made, and how you lock it in place once you have made it. The first depends on the thread count of the adjustment screws. Your typical hardware store screws have designations like 6-32, where 32 is the number of turns per inch. This type of screw is designed to bolt things together, but for precision adjustment purposes they are too coarse. Metric screws like M3 or M4 are a bit finer than the SAE equivalents, but still they were not designed for adjustment purposes. In a good paddle you want micro-threaded adjustment screws with a tpi (turns per inch) exceeding 40 or so. (some fine Italian makers are using 48 tpi on some of their paddles)

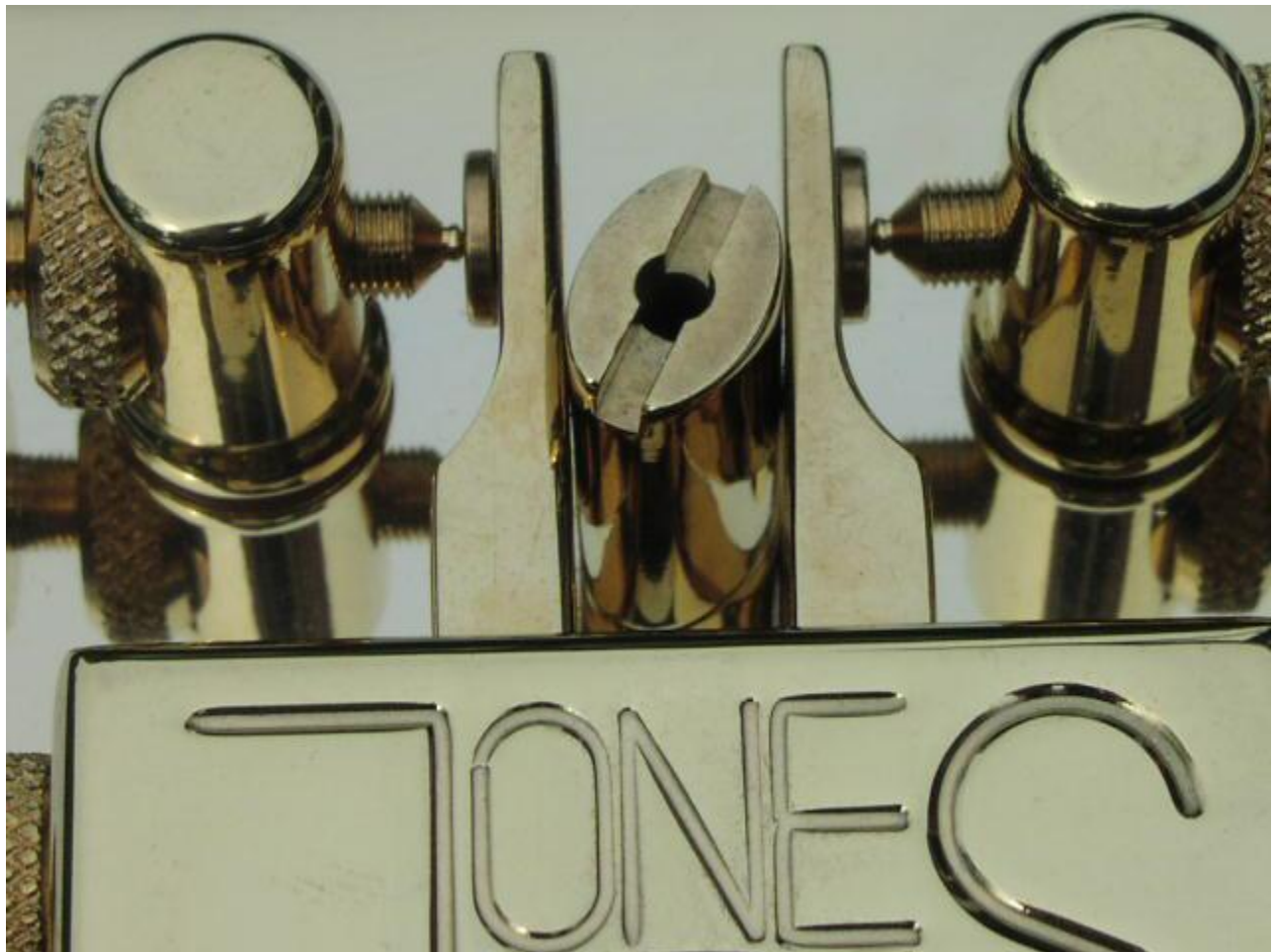
Once the adjustment has been made you want to make sure it stays put, and various approaches are in use for that. Most commonly you will find counter nuts - clearly visible in the Frattini up top. The disadvantage is that as you tighten the counter nut you actually pull the adjustment screw back by the tiny amount of play in the thread - so this takes a little bit of patience for really tight adjustments, but once it's locked it stays very securely in place. The Schurr, e.g., uses a split

post that can be tightened to increase the friction to the point where the adjustment screw will not go out of adjustment due to vibration of just casual contact:



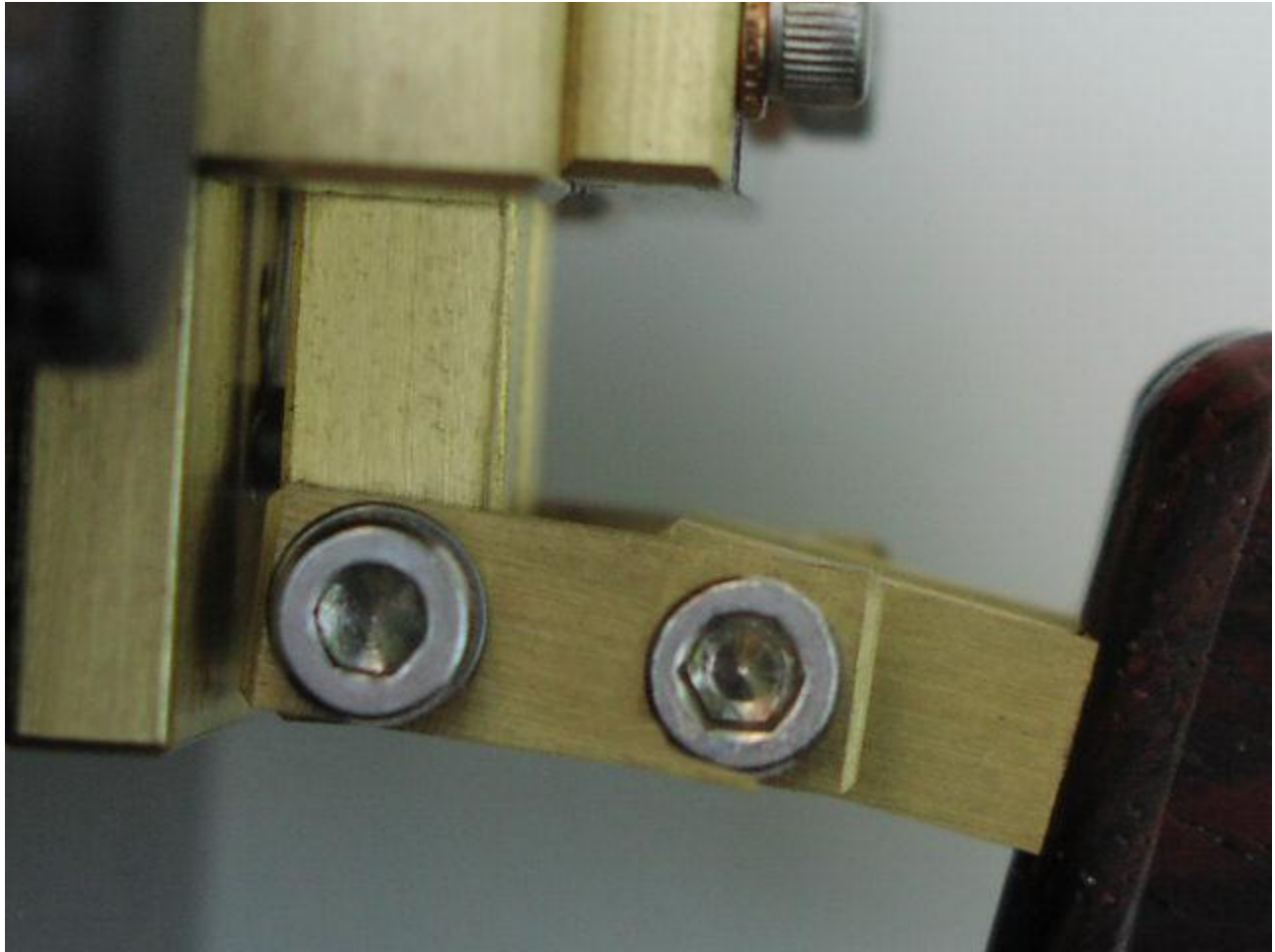
The Begalis use two different approaches depending on the model. One type uses a spring on the adjustment screw that creates enough tension to keep the screw from turning when you don't want it. His latest models use an invisible technique that is also used in the WBL: a spring inside the hollow post that presses a tiny ball against the adjustment screw. This is better than the friction spring in his older models because the friction force stays constant over the adjustment range.

Another aspect you probably want to adjust is the spacing and the height of the paddles. The spacing can often be controlled by adjusting the back stop of the arms. The Jones uses a nice approach with a rotating cam:



The WBL is well known for its total flexibility. You adjust the paddle spacing with washers (spacers) of different thickness as can easily be seen in the photo up top. It also allows you to adjust the paddle height using a fairly elaborate technique with two extension stubs on the arms. I personally think that is taking it a little too far because you obviously pay a price in mechanical stability - and properly shaped finger pieces feel comfortable at a whole range of heights no matter where you touch them, so there is no real pressing need for a complicated height adjustment scheme in many cases. (The upcoming Begali Verticale will use a tremendously elaborate technique, however - but that is justified by other factors)

Here's a side view of the WBL height adjustment (and also of the effects that oxygen has on unprotected brass, no matter how hard you try):



Mechanical robustness and corrosion resistance: you can build your paddle like a tank - and something like the Jones paddle feels like it could survive a direct hit by a large caliber. A lot of mass, however, often compromises the agility that you want in the best paddles. But it may well be, if you have a hammer fist steeled by many years with a mechanical bug, that sheer weight is an important factor. You certainly want your paddle heavy enough to stay in place on your desk even during the most agitated moments when you catch that rare DX or that final multiplier in a contest. For me a desktop paddle should weigh at least 2 pounds, and all the good ones do. A specialized mobile paddle like the Begali Traveler is, of course, designed with weight savings in mind, and for that purpose I expect and accept less mass.

Brass is used for the basic components of many paddles because it is easy to machine, it is heavy enough for a solid feeling, and it looks great - at least at first. However, it deteriorates fairly rapidly and develops spots or streaks from oxidation. That's why some makers give it a clear coat of shellac or some other varnish which reduces or delays this problem. However, in the long run even the best varnish develops some cracks or has some microscopic flaws, and oxidation spots invariably develop. You can, of course, just cover the base with an opaque lacquer, like the Kent

or the standard Jones paddles do - but the other components remain exposed. The best and also the most expensive solution is to plate the components - chrome has traditionally been used, gold for "Deluxe" models, palladium is a coating that Begali uses, and also various metal oxide coatings can be found (e.g. on the Begali Traveler that is shown up top). While most corrosion does not affect the performance of a paddle it sure is a lot more fun to work with something that looks beautiful even after many years.

While brass is a good material that is easy to work with, it is also relatively soft. Some makers, if they have the required machinery like Begali, use steel components. They are extremely robust, but it is very hard to polish them to a perfect mirror finish. With a good surface coating of gold or chrome, however, you will hardly see any traces of the milling process, and you have a base material that is virtually indestructible and doesn't oxidize.

Fortunately not everything can be cast into fixed rules when it comes to paddle design. There is, e.g., one paddle out there made of varnished brass, using trunnion bearings, and a combined spring to adjust the return force for both sides - not an obvious recipe for a great paddle, but many operators rate it very highly (answer: the Schurr Profi II) Which goes to prove that the balanced mix of all design elements is what makes a great paddle.

Looking at every design aspect discussed here, you will find that no single paddle on the market combines everything into the ultimate package. The paddle to end all paddles has yet to materialize - and I'm afraid that it will not have a price next to nothing. That shouldn't deter you from buying your dream key today because, no matter how sensitive your finger tips or how fast you are, the best paddles on the market will convincingly demonstrate that your own abilities are the limiting factor.

That's it folks - more than you ever wanted to know. Hope to see you on the bands! Ulrich,
N2DE (DJ8GO and a few more).

High Noon on Paddle Hill

[Ulrich H. Steinberg \(N2DE\)](#) on April 8, 2005

High Noon on Paddle Hill

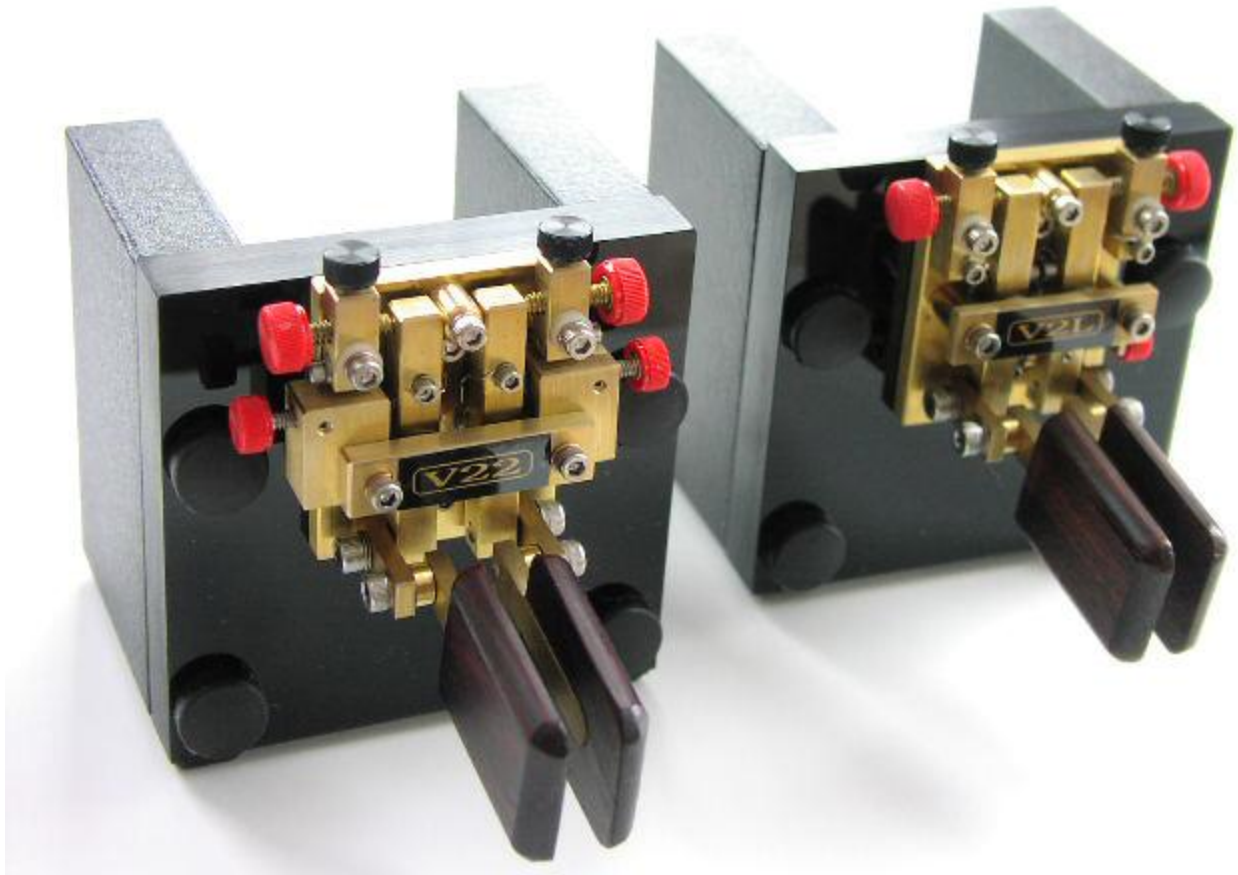
My previous articles on keys and paddles (see <http://www.eham.net/articles/8432>) have resulted in many email exchanges, mostly pleasant. One recurring question has been: “what is the best paddle that money can buy”.

Nobody can truthfully answer that question because “best” is such a relative measure. But not being one who shies away from hot water I decided to try anyway, and damn the torpedoes (i.e. flames) - but this article shows, admittedly, what I would buy, without any claims to universality. Originally I wanted to look at, say, the top five paddles in my collection, but then I became ambitious and decided to go with only three. If your favorite is not on my short list you can always console yourself that I probably didn't have an opportunity to try it - after all, I have to buy these things and I don't have an unlimited budget; my wife makes sure of that - or that your criteria are different from mine.

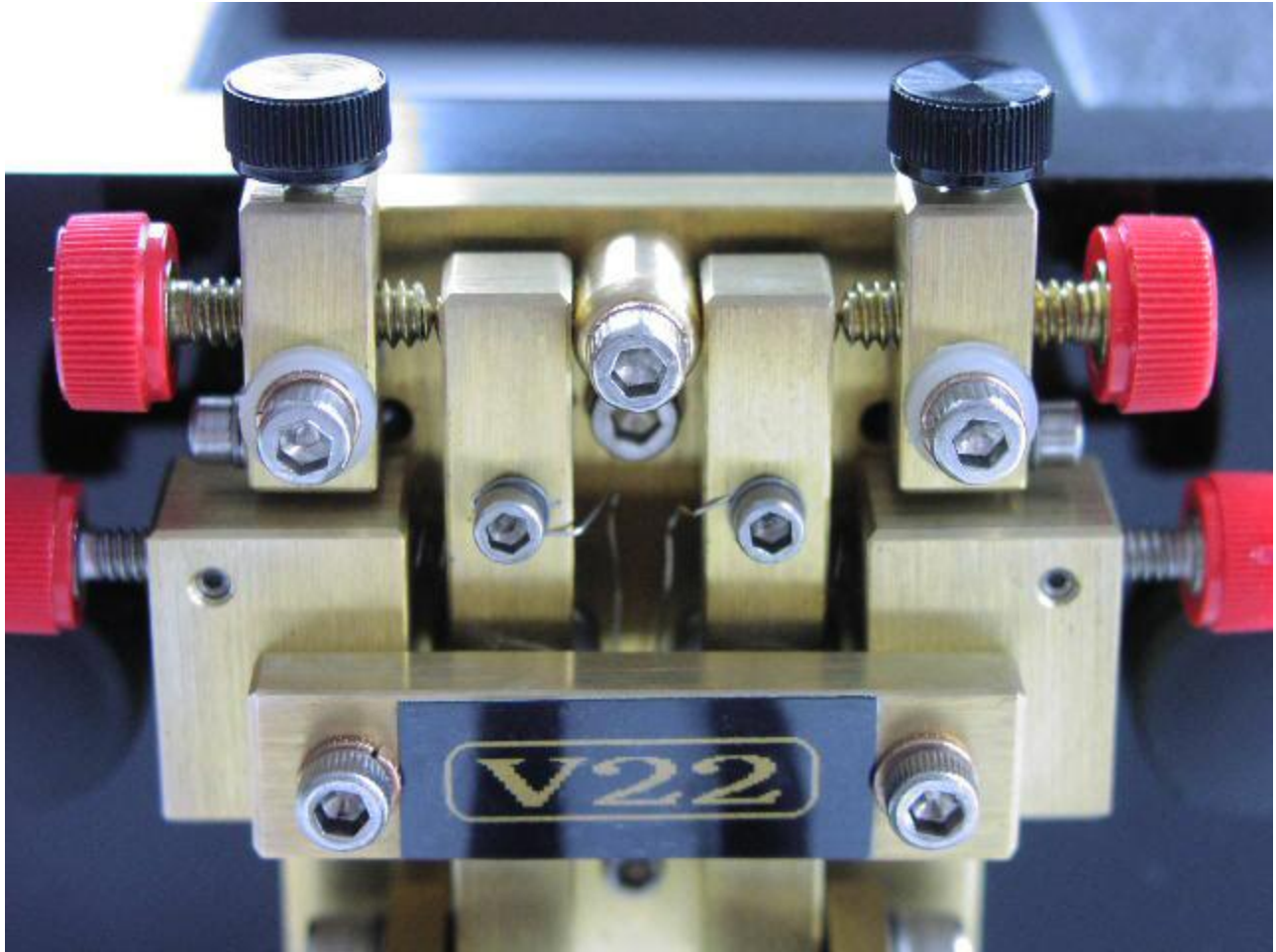
So what were my criteria for this selection? I wanted to look at dual-lever paddles that have an original design setting them apart from the me-too's, and that have performance characteristics that make them suitable for the most demanding cw operators. The price tag was not a consideration although, except for us paddle nuts, it probably would be if you had to pick a paddle. Also, the paddle had to be something that is not just a unique piece - there are some fine “designer” paddles out there, but you can't really buy them because only a handful or less were produced. All of the paddles that we're looking at here will be left standing when the smoke settles - we won't mention their competitors by name that ended up in the dust (after all, I'm not suicidal, and eHam probably wouldn't go for that anyway). And all of them are works of art and transcend their utilitarian purpose as paddles if you look at them from different perspectives.

So here's my short list: the WBL V22, the Begali Graciella, and the March R3a. Each of them differs substantially from each other and the crowd, each of them has stronger and weaker points, but they all are something to behold and treasure.

The V2x (V2L or V22) was probably the most radical departure from traditional design when it first appeared. There's little difference in the performance of both, the V22 and the V2L, and you can be proud of either one. The V22 has a little more flexibility in its adjustments and a slightly different geometry.



Stan can't deny that he's an artist at heart (he runs an art gallery in Indianapolis these days, although he was a research engineer by vocation), and the key was probably inspired by Bauhaus designs. It's just incredible how he combined black acrylic and brass and rosewood into a key that is way up there in technical performance. Some of you might question here why I make you drool over a key that is no longer available from the maker. Let me say this much: talking to Stan a couple of months ago, that's probably not the last word...



Earlier than most makers he realized the importance of minimizing the moving masses in a key by reducing the component size, and he maintained the ideal leverage ratio by opting for a vertical architecture. By bending the levers at a sharp angle at the bottom, the two sides of the lever can be made about the same length (1:1 leverage) despite the diminutive size of the mechanism.

Other elements of this key are part of a “black magic” that makes it hard to explain why it performs so well. It has very simple looking bearings, just steel pins that are centered inside stainless steel washers, and the return force is provided by springs (one spring for the V2L). In actual operation, however, all this combines into a key that can be set incredibly close, that maintains the settings regardless of temperature variations, and that is a pleasure to use at any speed.

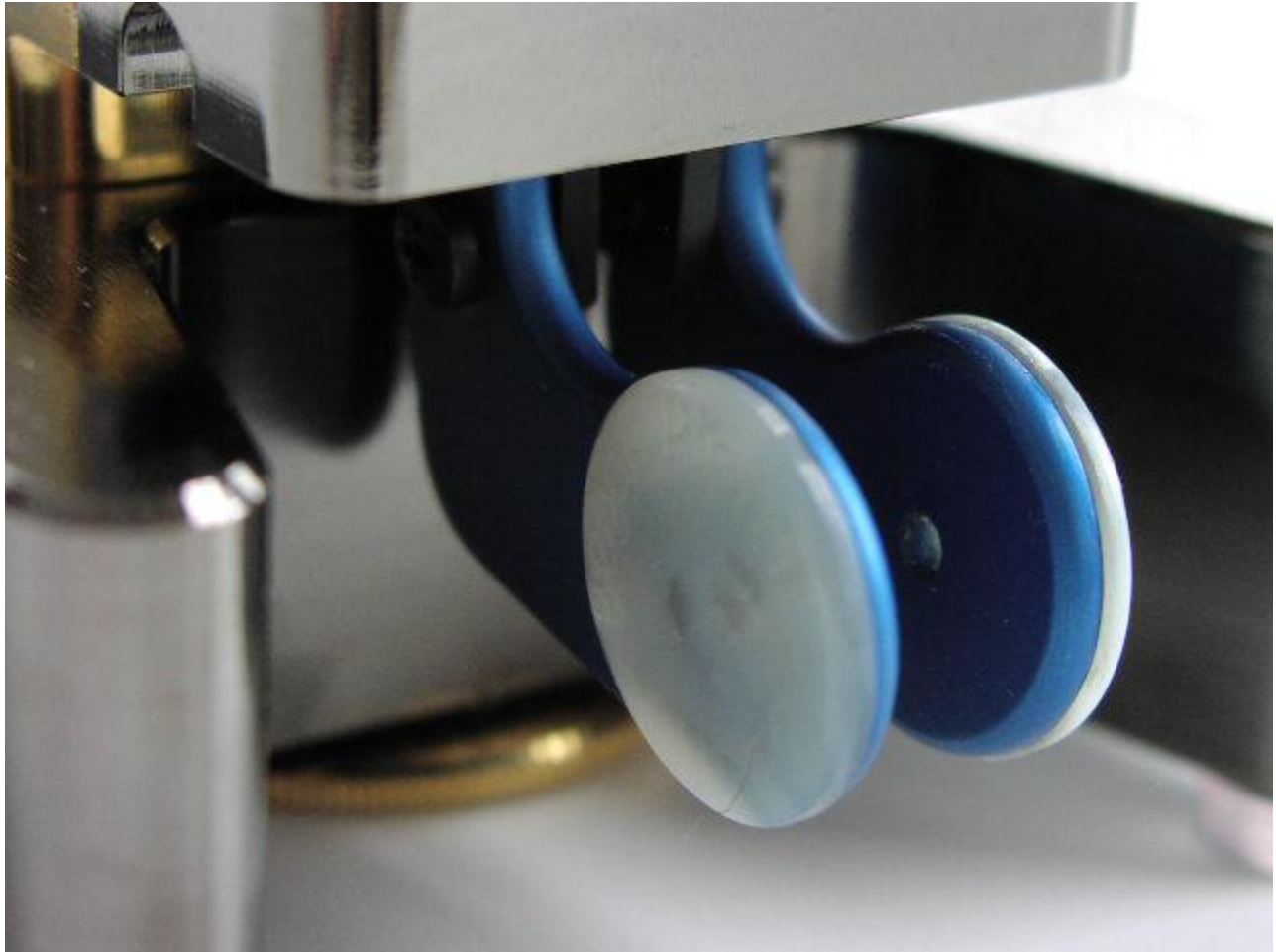
Does it have weaknesses? Sure: the light-weight construction of the mechanism makes it a bit fragile. You definitely wouldn't want to put this in your travel bag or subject it to a lot of mechanical stress, and it's not ideal for you if you have a hammer fist that is steeled by many years of using mechanical bugs. Also, the unprotected brass sooner or later will show signs of corrosion. (Stan has a gold plated V22G - but for now he's not sharing that with the world. We'll

see ...) But you don't judge a modern sculpture by it's tolerance to being slapped around, and none of this is a real show stopper for me.

When I started talking to Piero Begali about the design of my ultimate paddle we soon realized that a vertical design would probably be the best approach to achieve the performance parameters that I had in mind. His approach to engineering, and his mechanical abilities with NC controlled machinery that few other makers could afford, however, resulted in a key that has no resemblance to the V22, or anything else on the market for that matter. Every element that went into it, from the surface finish to the instrument grade bearings, to the space-age alloys, is state of the art.



I can't be totally impartial here because I was too deeply involved with the creation of this key. But I think it's fair to say that he combined top-notch components into a package that exemplifies the best of Italian design, industrial grade robustness, and performance characteristics that are hard to top. The elaborate way to adjust the spacing and the height of the mechanism allows him to use fairly small and light finger pieces, and put them exactly where they feel most comfortable for you.



Does it have weaknesses? Hardly, not for me anyhow, but your personal habits and priorities may be different from mine. If you tend to move your hand a lot while keying, e.g. if you come from a long history of using bugs or single lever keys, the space around the finger pieces may feel constricted. I tend to have a minimal contact gap for my keys, I use just my thumb and index finger for keying, and I barely move my fingers sideways - for me this key is perfect. It combines the advantages of a vertical design with the extreme robustness and the plated surfaces that the V22 didn't have, and it exudes a spectacular beauty that even a person without CW skills can appreciate.

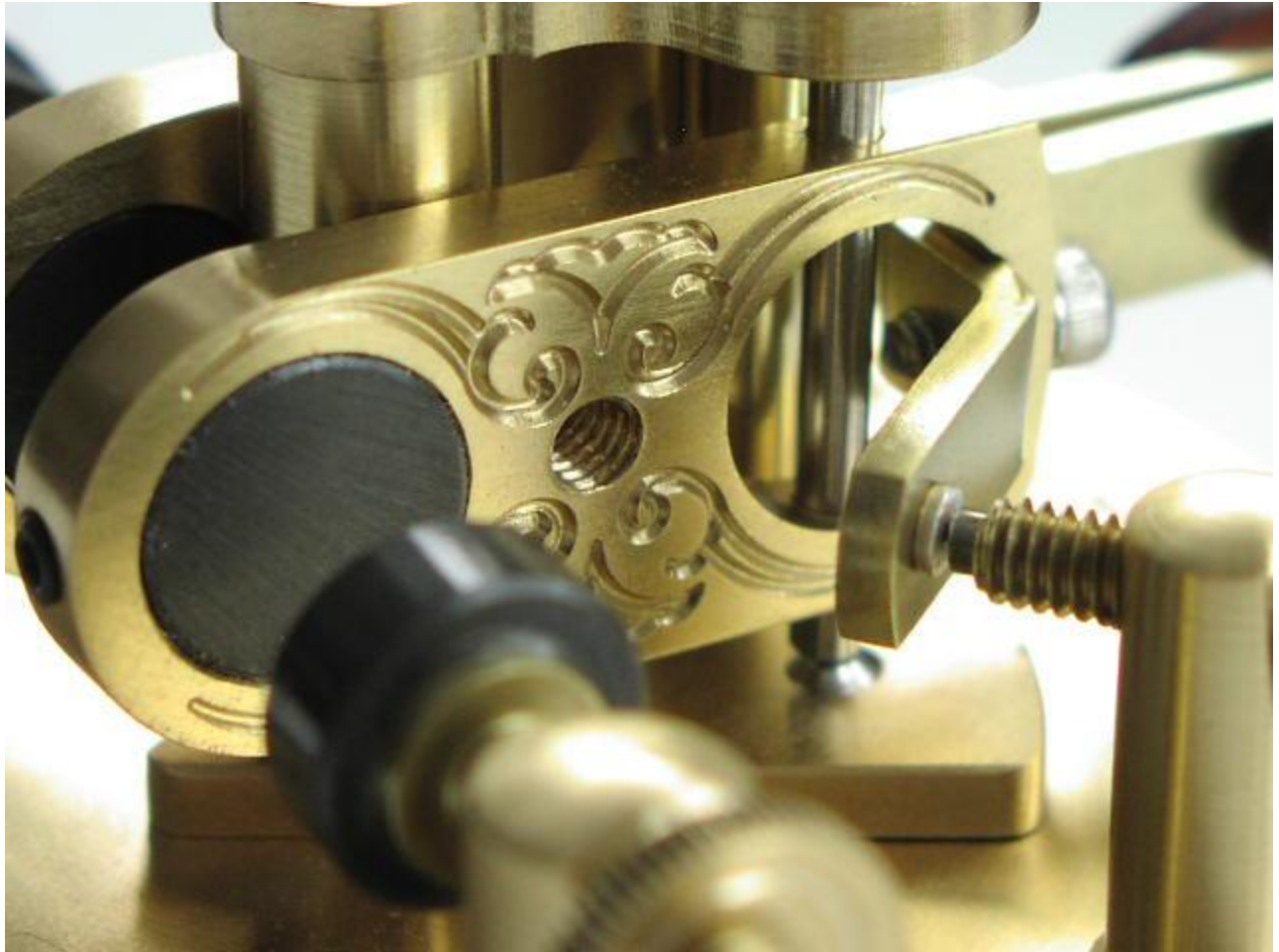
One small anecdote: how did the Graciella get its name? Well, Piero's wife, Grazia, is called Graziella by their friends, and she passed her ham radio license just around the time we were playing with the first prototype of this key. So with my rudimentary Italian, not realizing my typo, I suggested to call the paddle Graciella in her honor. Piero told me that he liked the sound of that, although it really wasn't her name, but that in the local dialect her nickname actually sounded more like Graciella. So, now you have it from the horse's mouth.

The March R3a would probably be on many short lists because it has a unique visual appeal and is not just a ho-hum knockoff of some other design. When you first hold this key in your hands, the amount of plain old-fashioned workmanship that is required to create it is obvious. It is

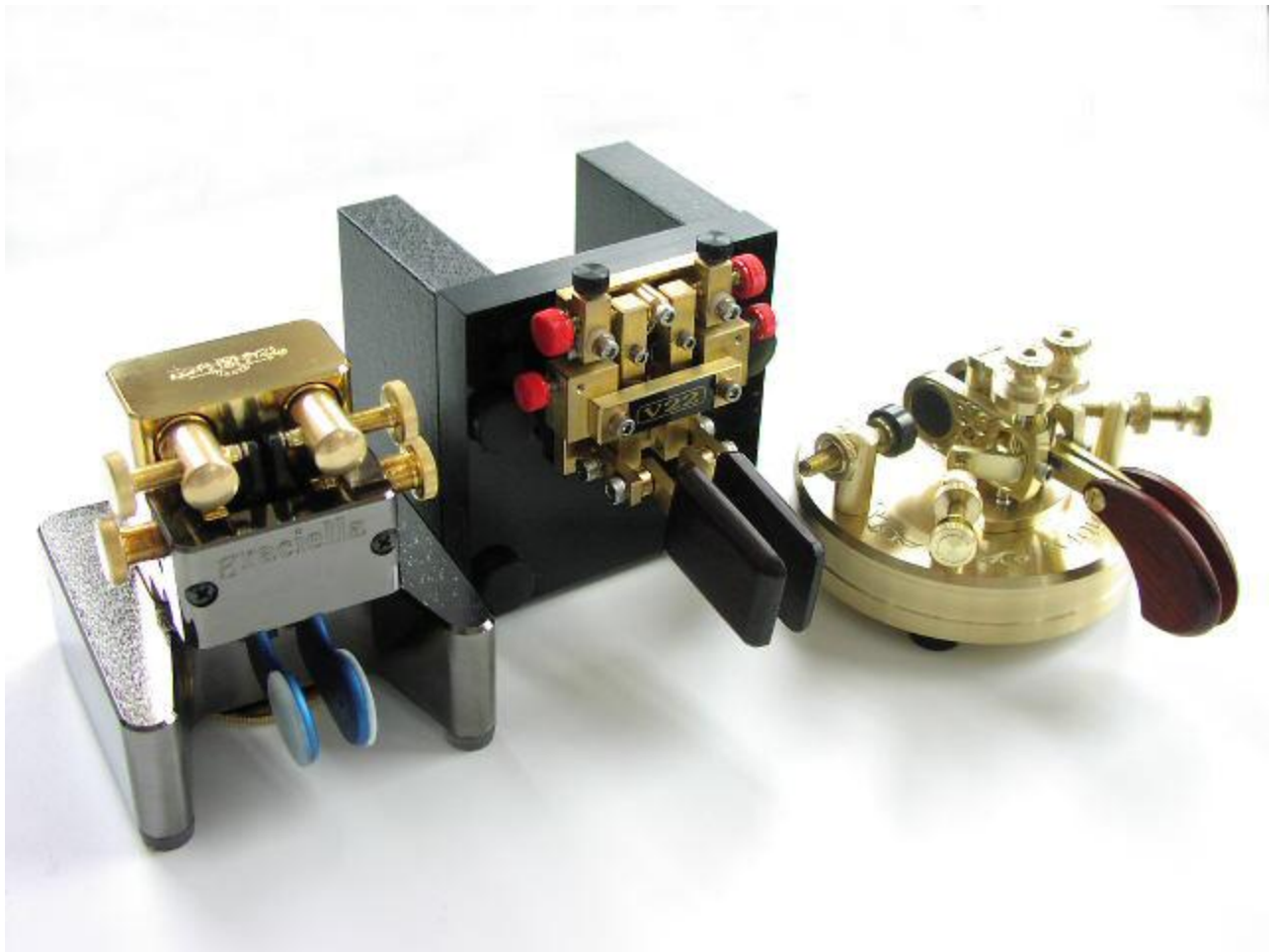
reminiscent of the days when people were proud enough of their guns to have them artfully engraved, and with its baroque looks it is as unique in its own way as the V22 or the Graciella.



Mike opted for a design that uses repelling magnets, like the Graciella btw, at a time when all other magnetic keys used attracting magnets. Although the movement of the levers is minimal, and in theory there should hardly be a difference, somehow the increasing force as you close the contacts, like with a spring design, imparts a different “feel” for many operators. The T-shaped arms keep the magnets and the contacts close to the pivot point, and the resulting low angular momentum of this paddle makes it very responsive at higher speeds. Although it doesn't have the flexibility of the V22 or the Graciella to adjust the geometry, the finger pieces are well shaped to feel comfortable at different heights, and the spacing is a good compromise that should satisfy most operators.



Does it have weaknesses? Sure, but the few things that could be improved from a technical perspective actually add to its visual charm: the adjustments use relatively coarse threads and lock nuts, which makes achieving really close settings more difficult than with the V22 or the Graciella, and, like the V22, it is not designed to take mechanical abuse. But, like a precious grandfather clock, you'll probably catch yourself adjusting and polishing it all the time for sheer pleasure, and you won't see that as a flaw.



So, which one would I pick if I had to chose? To tell you the truth: all of them. Depending on my mood, one would serve as a paddle, and the others would just sit there in the meantime to be admired as works of art until it's their turn for air time. And if you press me really hard? Well, I won't tell you, and I leave it up to you to guess.

The Foothills of Paddle Mountain

[Ulrich H. Steinberg \(N2DE\)](#) on December 10, 2005

The Foothills of Paddle Mountain

In one of my recent articles I discussed top of the line paddles (see <http://www.eham.net/articles/10577>), and the responses by email have been many and varied. I received a whole stack complaining that XYZ should have been in my narrow list of contenders for top honors - I guess that can never be avoided, because, how can something that you paid a lot of money for not be considered top notch by everybody else :-). A more serious argument, however, was: How about looking at the price tag - not everybody is a paddle nut who just ignores the price. What about some good paddles in a more affordable price bracket?

I have no doubt that my selection here will raise some criticism, too, but that's the nature of such a subjective issue as "good" paddles.

My selection criteria for paddles are always the same: sound architecture, i.e. geometry and basic constructive elements that allow precise keying (see <http://www.eham.net/articles/8432>), and good workmanship. The paddles I'm showing here are, in my opinion, excellent values in the price range between \$140 and \$180. If you go significantly below that price bracket you often end up with compromise solutions that won't survive on your desk in the long run, and after a couple of attempts you end up spending more money than you would have paid for any of the paddles I'm showing here. Yes, yes, I know that you can be happy with two hack saw blades and a block of wood, or with contraptions made from a paper clip and two buttons from mothers sewing basket, but this sort of thing always had a pretty short life span on my desk and is not in a league with these paddles. So, here we go:

The Kent TP1:

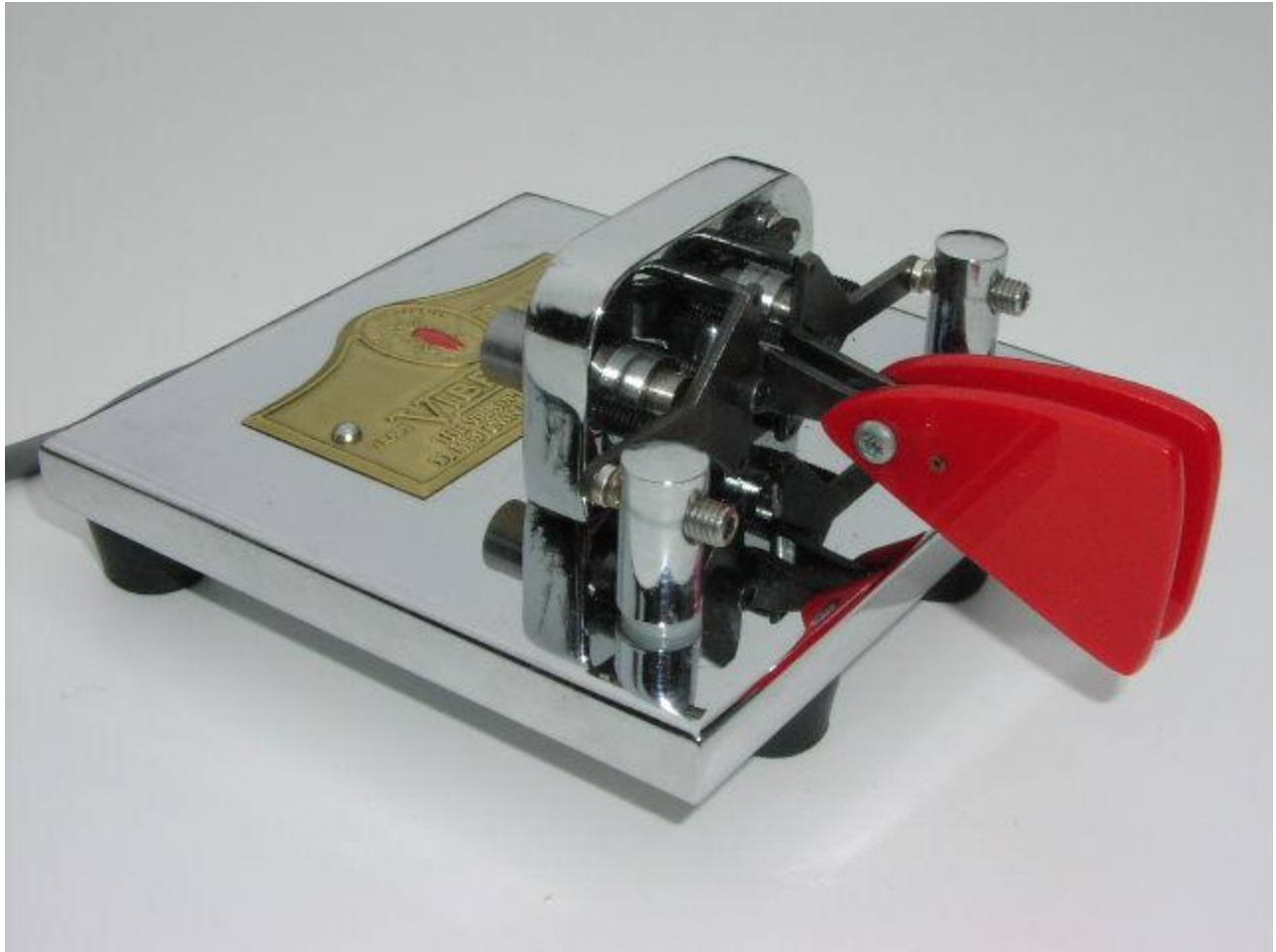
This is a classic key with solid English engineering, and it has served as a model and template for many other paddles over the years. It uses springs to provide the return force, and the brass parts are unprotected and need regular care to prevent oxidation. The racing bearings, the mass distribution, the precise adjustments, and the flawless workmanship make this a very good paddle with excellent responsiveness and good feedback.



One weakness that I never understood is why they attached the finger pieces to the levers with two screws that are aligned vertically and spaced very closely - sort of a natural perforation ... Fortunately you can always get replacements at a reasonable price if your temperament gets the better of you and you break them.

The Vibroplex Square Racer:

The basic design of this key dates back to the 70's, when it was the Hamco Scotia, which was then bought by Vibroplex and continued almost unchanged as the Vibroplex Brass Racer. The mechanism in the Brass Racer and the Square Racer is the same: a frictionless suspension and magnetic returns, using light-weight arms made of a ferromagnetic material (meaning that there are no magnets mounted on the arms, which reduces their moving mass even further). This creates a movement with excellent agility that is suitable for high speeds. The workmanship is flawless, and the sight of chrome and the red finger pieces is very attractive.



The adjustments for the contact gap require a small hex key and a bit of patience, but they hold well once you've found your optimum setting. The strengths of this paddle, its light weight mechanism and low moving mass, also imply that it's not a particularly robust key. But if you have a gentle touch, you will be happy with this key.

The MacKey by ON4MAC:

If you know a bit about paddles, you'd say that it resembles a Schurr with the finger pieces of a Begali. In reality it's a larger key that surpasses the Schurr in several other aspects, too. When Michel, not too long ago, decided to try CW, he did what these master mechanics (fortunately for the rest of us) tend to do: he decided to start out by building a decent paddle for himself. He's the first one to admit that he looked around and picked what he thought were good ingredients for a paddle. The result is an outstanding key in the tradition of the great European key makers.



It has many components of a top notch key and the unmistakable handwriting of a master craftsman. The brass is not protected, so, like the Kent, you have to give it some loving care. The magnetic return force can be adjusted precisely, and, in combination with the sealed ball bearings, it allows very light settings with excellent responsiveness. You would be hard pressed to find a better performing key at any price, and at about \$180 it is a real bargain. Michel produces these keys slowly and carefully by hand and, of course, he doesn't have a stock pile of them. So you may have to wait a bit if you want to treat yourself to one, but it's worth it.

The Begali Simplex:

This is the key that put Piero on the map of the great key makers, and over the years it has been further refined into the outstanding key that it is today - a true bargain if you look a little closer: all component surfaces are gold or palladium plated, the arms are a light-weight aluminum held in ball bearings that are hidden in the base, and the micro-threaded adjustments are very precise. And, although beauty is in the eye of the beholder, the Italian design combining function and elegance is unmistakable.



There is also an innovative single-lever version of this key, the Simplex Mono, which would be an excellent choice if you come from a mechanical bug and haven't quite gotten the hang of "squeeze" keys.

You can't go wrong with any of these keys. They embody a level of perfection that leaves little to be desired, and all of them will remain on your desk for a long time.

American Beauties

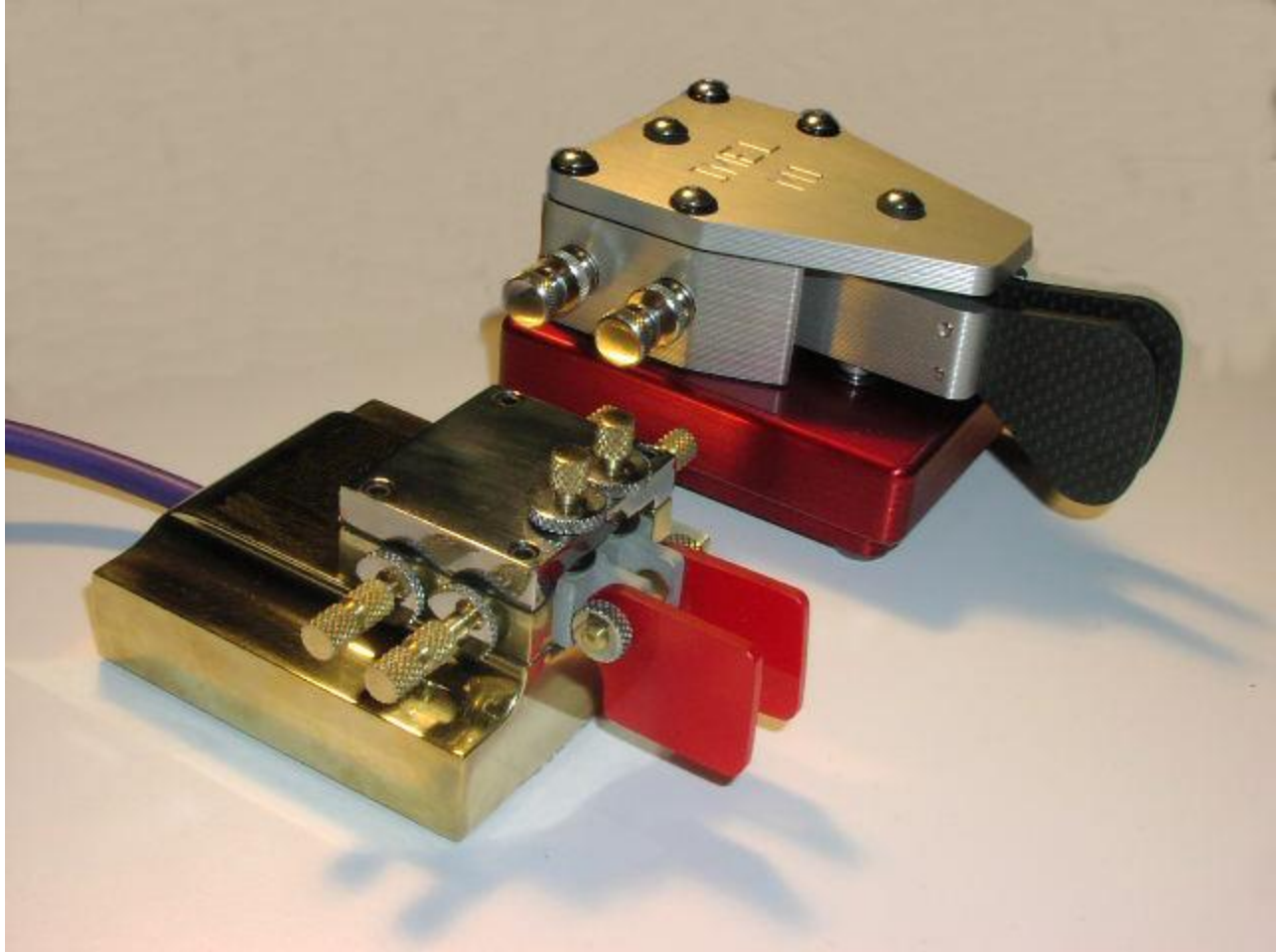
[Ulrich H. Steinberg \(N2DE\)](#) on January 26, 2006

American Beauties

The price range between \$250 and \$350 for dual-lever paddles is densely populated. Although you can get good paddles at a lower price (see my last [article on eHam](#)), many makers tend to aim a little higher to at least have a half ways decent return on their investment in machinery and time. A purely handmade quality paddle takes about 30 hours of skilled craftsmanship, and simple arithmetic tells you that it would probably be more profitable for a master machinist to flip hamburgers. And if industrial techniques are used, the requisite machinery could certainly not be amortized by just making paddles. So, even if \$300 sounds like a lot of money for a paddle it is in reality a steal, and we can be thankful to those master craftsmen and machinists who dedicate their time and skills to something that they obviously love with total disregard for profit.

A while ago, when I published an article on the [anatomy of the perfect paddle](#), you were by now means assured that even spending this much money would buy you a paddle that could hold up to technical scrutiny. Actually few paddles then implemented the ideal of low moving masses, 1:1 lever geometry, and high quality bearings, all in a rugged package that would remain beautiful for many years. But, as a testimony that the doomsday messages proclaiming the death of CW have been greatly exaggerated for at least the 44 years that I have been using it as my primary mode, new paddles are being developed all the time, and occasionally some really great ones come along.

Of course I can't claim that I know, let alone have tried, each and every paddle on the market - my wife makes sure I don't -, and there may be some really good ones out there that have eluded me so far. Thinking back to new paddles that attracted my interest in 2005, however, the Imel M1 and the WK4DS immediately come to mind.

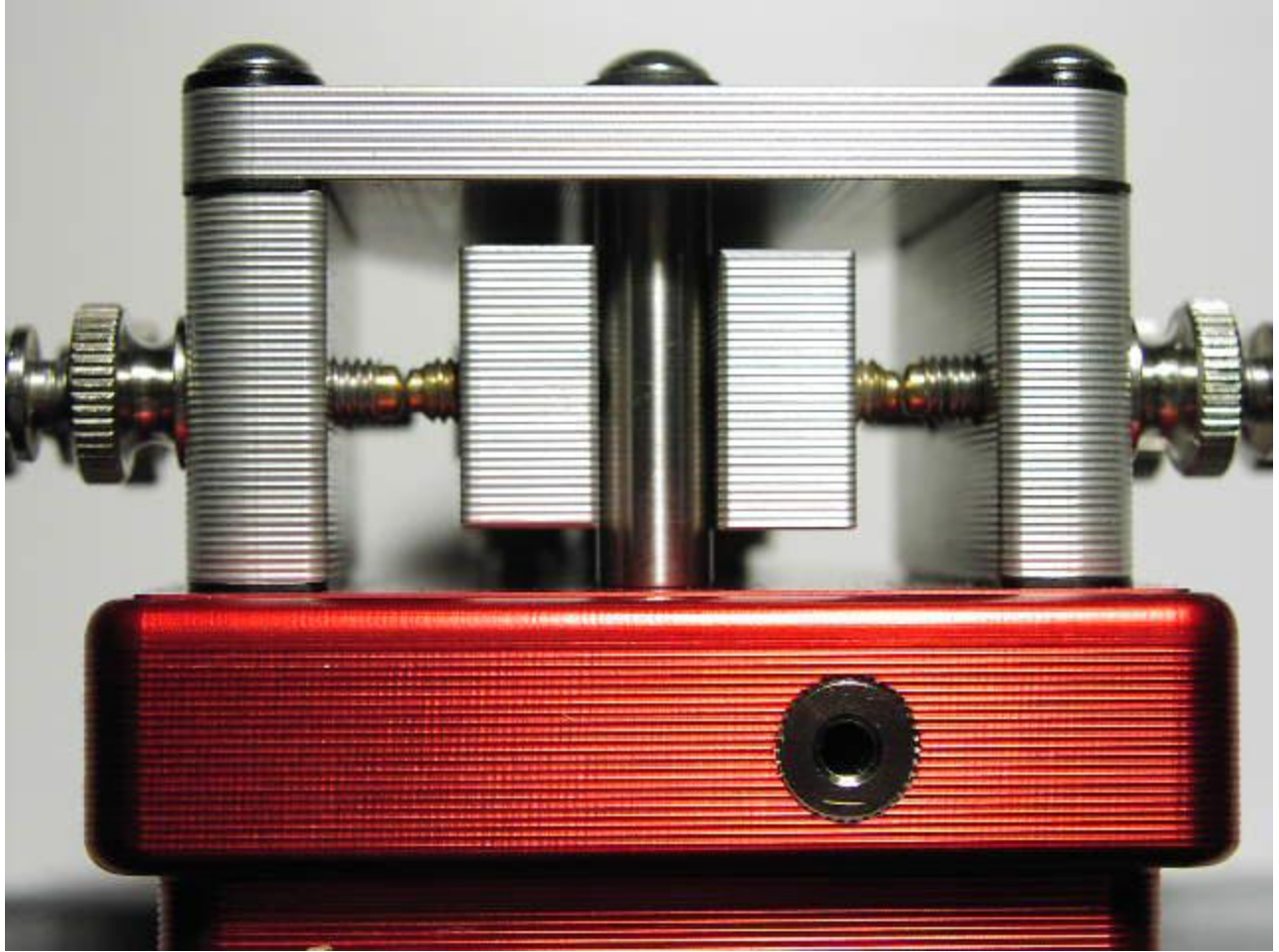


Let's take a closer look at similarities and differences and find out how and why they both deserve high marks.

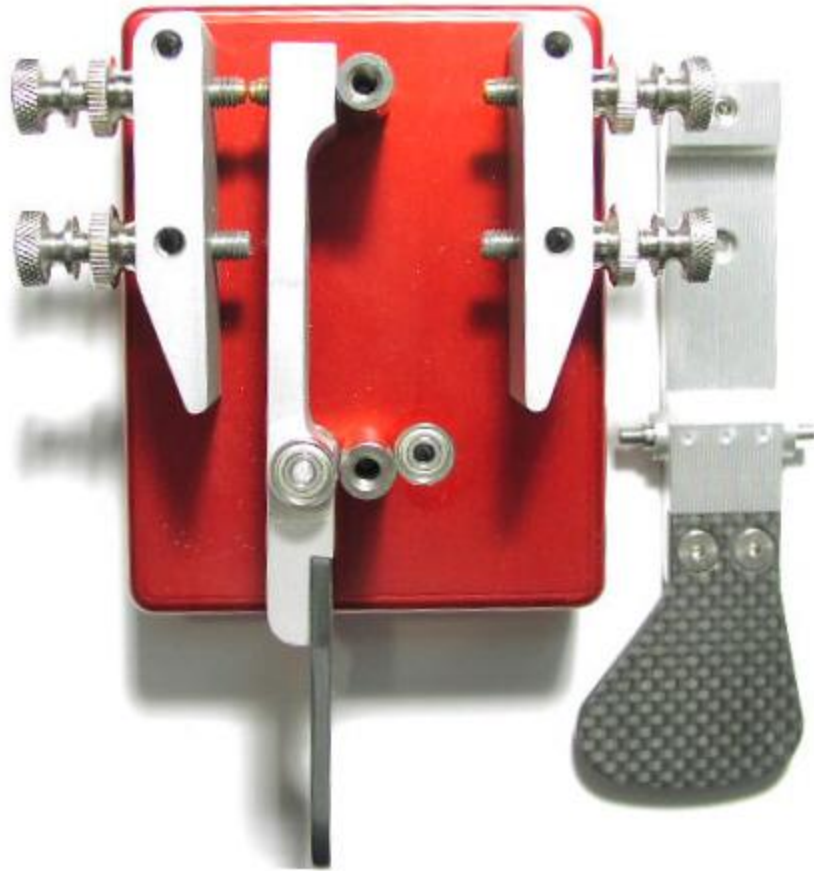
The Imel M1 is produced on precision NC machinery and meets tolerance criteria that are almost impossible to achieve with manual techniques. When you take it out of the box the immediate impression is that this could be a component of some high tech weapon, developed in a world where a hammer costs \$600 :-). It is a large paddle, much larger than the WK4DS, and that size gives it enough weight to stay securely in place despite its aluminum construction.



Click precision, advanced materials, near indestructible are some of the attributes that come to mind. The reinforced carbon material for the finger pieces is something I haven't seen before. It is much stiffer than the typical plastic material used in other paddles and provides excellent tactile feedback, similar to metal finger pieces without the cold metallic touch. The finger pieces are well shaped and are spaced perfectly for my taste, but the new M1A paddle will even have adjustable spacing. The “ribbed” finish on vertical surfaces provides a secure grip when you move it around and makes it impervious to fingerprints. The stereo connector for the cable is a nice touch and seems increasingly common on the better paddles.



But, of course, mechanical quality by itself wouldn't make a great paddle. So let's do a little anatomy here and peek under the hood. (Boy, we really should have a magazine for us key nuts with a center fold that shows paddles with their top off :-)

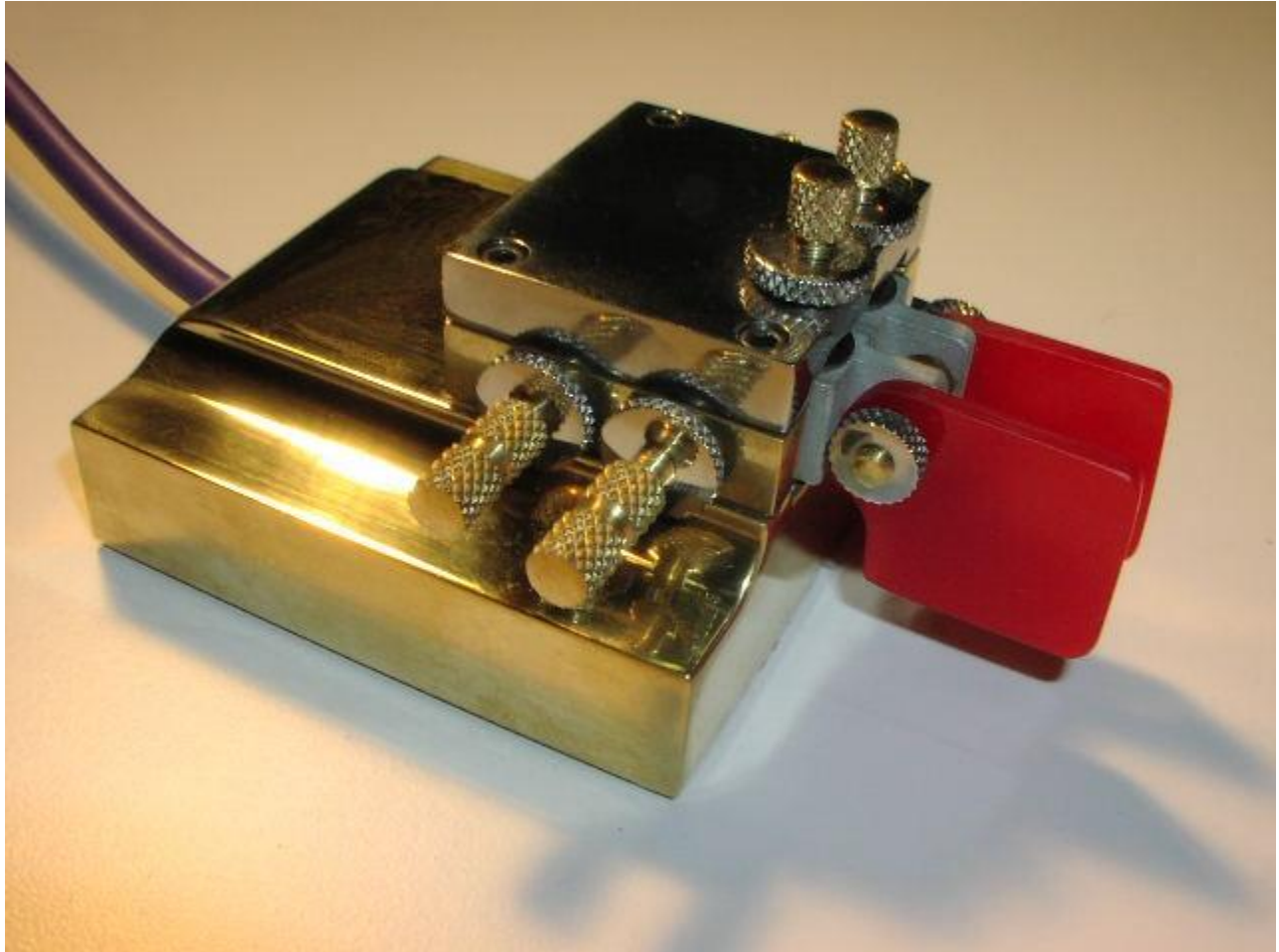


The arms are held by four precision bearings, and they are thinner in the middle section for further weight reduction. You can see that the contact side of the levers is longer than the finger side. Therefore any variations in the contact gap due to temperature fluctuations appear smaller to your fingers - but the material is pretty insensitive to temperature changes to begin with. The magnets are very small and strong, and they are mounted relatively far from the pivot point. The adjustments use relatively coarse threads and lock nuts, and they require a bit of patience, like all such mechanisms, to get them right. But once you have found your optimum setting they stay firmly in place.

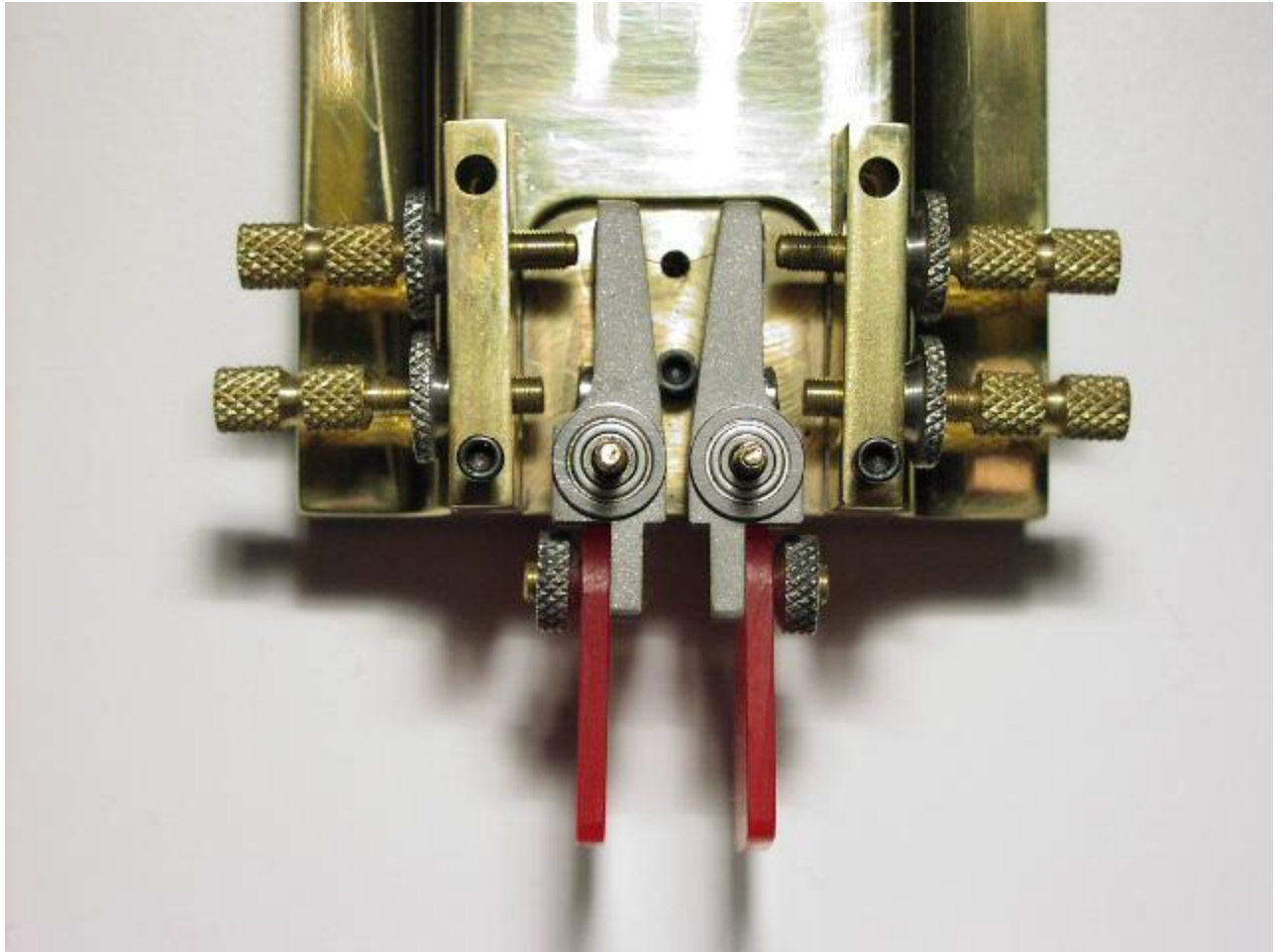
This paddle is best used with a small contact gap, and the mechanical stability and precise machining lends itself to that. The relatively long lever on the contact side, with the magnet a fair distance from the pivot, lets you feel (and hear) bounce and vibration effects if you use a wide gap. (because the lever accelerates over a longer distance, gathering more momentum before it comes to a stop, compared to a small gap) With a small contact gap, however, this doesn't matter much, and this clearly is an excellent paddle, which provides a fairly unique balance of ruggedness and precision. I think a hypothetical M2 could be made even better with little effort if they shorten the arms on the contact side, so that the contact is where the magnet is now. The

magnets and the two “walls” with the adjustments would move forward correspondingly, and the base could be shortened.

David, WK4DS, puts at least 35 hours of work into each and every paddle, and the result is a stunning key with graceful lines that rival the design of some fine Italian paddles. While the M1 exudes the flair of high tech engineering, this paddle is more like an art object.



But the beauty is more than skin deep. Let's peek under the hood (and give David a heart attack when he sees what I do to his beloved keys).



It is remarkable how David practically attached the finger pieces to the precision bearings, creating a very short and light lever, one side of which is just the finger piece. The magnets are mounted as close as possible to the pivot point for the lowest possible angular momentum. The lever with the contacts, the magnets, and the finger pieces weighs about 0.5 oz - actually it seems impossible to have a shorter lever in a paddle. This, in combination with the high grade bearings, provides excellent responsiveness at high speed, without the slightest trace of vibration.

The adjustments use fine 56tpi threads, and as an option you could even have 72tpi screws for the ultimate in precision. If you look closely you can see two thin grounding wires coming from the contacts - this makes sure that there's always a perfect return path. The base and other major parts are made from unprotected brass and will need some tender loving care over time...

Clearly, this is one of the best implementations of the principles that I outlined in my “anatomy” article, and it's reassuring to see that my theoretical musings, when put to practice, actually result in an outstanding key :-)

Both of these paddles were created with different goals in mind, and they succeed admirably. The Imel M1 is a perfect “industrial” workhorse that can take a beating and doesn't mind being grabbed and lugged around, and the non-corrosive materials will let it stay like new forever. The

WK4DS is a high-performance race horse that you wouldn't dream of throwing into your suitcase. It has performance characteristics that let it see eye to eye with some of the legendary paddles, and polishing it every now and then will be a pleasure.

Both keys will continue to see a lot of airtime here, in very good company with other top notch paddles that I own. Contrary to all doomsday predictions this seems to be a great time for fine CW instruments - at least I can't recall a period when so many outstanding keys appeared on the market within a few years, and I can hardly wait to see what comes next.