

Funny Noises
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Great Expectations III
Not just a matter of opinion.

Sometimes a popular misconception gets in the way of practicality. Such is often the case with operators' opinions as to appropriate materials for the contacts in keys and paddles.

A telegraph key or paddle has only one or two sets of contacts. In a traditional straight key, there is an upper contact and a lower contact. In a paddle, one or two levers move horizontally between a left contact and a right contact. In radio telegraphy the contacts complete a circuit that carries a signal to a transmitter or to an electronic keyer. The voltage and current of the keying signal will depend on what is being "keyed" but in practice they can range from a few volts and milliamps (modern TTL switched transmitters and keyers) to hundreds of volts and amps of current (cathode keyed transmitters).

Contacts are distinguished by size, shape, and materials, theoretically chosen to be appropriate to the job at hand. Over the years a wide variety of contact types has been used in straight keys and paddles. Some are better than others, some are thoroughly over-engineered, and some are just dead wrong. With modern equipment it usually doesn't matter very much, and contact materials can (and often are) chosen for marketing reasons. Looking at the common contact types found in keys and paddles, I wondered to what extent the keymaker's choice of contacts was determined by market forces rather than engineering principles. So I conducted a survey on my web site :

What do you think is the best type of contact to use on a straight key or paddle?
Assume cost is not an issue.

Copper or Brass 5 %

Tungsten 2 %

Silver 30 %

Gold plated or solid gold 45 %

Doesn't Matter 12 %

Other (Specify) 6 %

In the “other” category, several users suggested that best type of contact would depend on what was being keyed, or on extraneous factors like ambient temperature and humidity. But “rhodium” also got a mention on the stated grounds that it is immune to tarnishing and corrosion. The only use of rhodium that I have heard of was in the original N2DAN Mercury Paddle.

Well, as a couple folks guessed, there is an actual “correct” answer and it is not a matter of opinion at all. The best material for contacts is silver, period.. Given a reasonable amount of care in the shape of the contacts (they should be slightly convex) and the repeatability of the closing motion (the levers and bearings should provide for stable and consistent operation), there are two critical factors which influence the choice of material– conductivity and sustainability, and by sustainability I mean that they should not require frequent cleaning or other maintenance.

Of the materials listed, the most conductive is silver by a considerable margin, followed by copper, gold, rhodium, and tungsten, with tungsten generally thought of as being resistive rather than conductive. Tungsten deserves a mention because it was commonly used in high-current relays, and high voltage contact points in car ignition systems, where its primary virtue was the ability to handle very high temperatures and arcing without self-destructing. Relay contacts and point sets were readily available to key makers at a time when the keying voltage and current were high enough to present problems. With a high-current, high-voltage key line you are not like to be worried about resistance as much as arcing and burning.

Corrosion and tarnishing are a problem with copper and brass contacts, because the metal oxidizes in room temperature air. You can add alloys to reduce corrosion, but they also reduce conductivity.

Gold does not tarnish or corrode, and that is the main reason that it is used in high-reliability connections like computer cards. But at the same time, it is expensive, and not as conductive as copper or silver. Gold plating is delicate and easily damaged. A side effect of gold’s ductility is that the surface of the contact is extremely smooth, having a polished appearance. This smooth surface attracts deposits of foreign vapors from the surrounding air, resulting a more frequent need to clean the contacts. Nobody smokes in the shack anymore, but we do still solder and if we are lucky our XYL’s still cook– two common sources of vapors which can plate out onto a smooth contact surface. Yes they are easy to clean, but every cleaning operation removes a bit of gold.

In contrast, the silver salts and oxides that result from ordinary atmospheric “tarnishing” are conductive, so the black tarnish on silver contacts (a) does not interfere with effective operation and (b) protects the underlying silver from further corrosion.

So just how much difference does conductivity make? Usually not very much but there is a story going around.... It seems a purchaser of a high-end transceiver was surprised to find that his super-high-end paddle (with *solid gold* contacts) would not reliably key the transmitter. It turns out that the keyer in the transceiver used a single input for all four paddle states (open, dit, dah, both). This was done by putting resistors in series with the paddle levers, and measuring four different voltage levels on the single input pin rather than the normal two states (on/off, high/low or logical 1/0). The resistance of the paddle (cable, wiring to hot contact, through contact, return path) was high enough to change the voltages beyond the latitude that had been allowed for. The transceiver manufacturers response was to design an “interface,” namely a solid state relay to sit

between the paddle and the keyer and provide the proper voltage levels. Apparently that was easier than redesigning the keyer, or trying to convince the user that his solid gold contacts were causing the problem!

But solid gold contacts are a rarity, and most serious CW operators would probably rather spend the money on something else if they really thought about it.

Bottom line is that virtually any contact material will be fine with modern equipment, the only apparent difference being how often the contacts will need to be cleaned. And armed with the lore presented here you can smile knowingly and say “no thank you” when a vendor offers you gold plated contacts at a higher price.