ELECTROCHEMICAL MACHINING: A NEW BARREL MAKING PROCESS

ROGER E. PAPKE

A small firm in Rochester, New York has developed a process for forming rifling in barrels which involves no cutting or pressure forming of the metal. The process is stress free, burr free, and involves no significant heat. It may also be used to form or finish other metal parts to exceptional smoothness and close tolerances.

We first became aware of the process while visiting Coonan Arms, the Saint Paul based manufacturer of 357 Magnum pistols. Dan Coonan mentioned that he would be getting barrels rifled by electrochemical machining (ECM). Through Coonan, we contacted Victor Vishnitsky of the Cation Corporation and arranged a visit.

Vishnitsky explained that ECM was not new, and had been used by Krupp to make cannon barrels in the 1920's. However, until Cation developed their equipment in the last three years, it had not been used in the United States for commercial firearms.

The process works by dissolving metal into the desired form. In forming the rifling for pistol barrels, a mandril is made in the form of a brass rod 0.02" smaller than the desired bore diameter. A series of plastic strips are glued to the mandril in a spiral pattern corresponding to the desired shape of the lands. The mandril is inserted into the barrel blank, which has already been drilled by conventional means. The plastic strips contact the surface of the bore, centering the mandril and protecting the surface of the lands from the ECM action.

An electrolytic fluid is circulated through the bore, traveling in a spiral pattern between the plastic strips. The surface of the barrel in contact with the plastic remains unchanged and forms the lands. The area between the strips, in contact with the electrolytic fluid and opposite the brass rod is dissolved, forming the grooves.

The procedure involves applying a direct current to the brass mandril which acts as a cathode or negative pole, and the barrel which acts as the anode or positive pole to form a circuit. For a short barrel, the process takes only a matter of a few seconds application of current. The mandril is not affected by the charge, and does not wear or require resharpening as does more conventional tooling. Tolerances can therefore be maintained, guaranteeing consistency and accuracy.

The process will cut any metal. Therefore, extremely hard and durable materials may be used without adversely effecting machinery costs. In addition, variable shapes may be formed which are difficult to cut or swage. Gain twist, twist of increasing or decreasing depth or width, or exotic rifling contours (octagonal, etc.) can be formed.

The process as described, with a full length, stationery mandril, is currently limited to a 10" overall length. With longer barrels, current drop and changes in the electrolyte cause unacceptable varying tolerances. A new approach and entirely different equipment had to be developed to handle the problem.

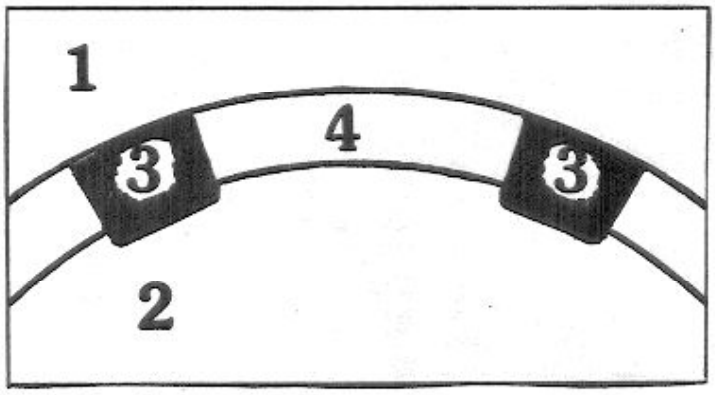
MINNESOTA BCA CRIME LAB - ST. PAUL, MN

Barrels for long guns are currently being rifled with a short traveling mandril, which revolves as it is moved down the bore at approximately 20" per minute. A variety of barrels, including .22 and .30 caliber and rifled 12 gauge shotgun barrels are currently made with this procedure. Most manufacturers have prototypes of ECM manufactured barrels and are currently evaluating the process. No one But Coonan is currently committed to using ECM manufactured barrels.

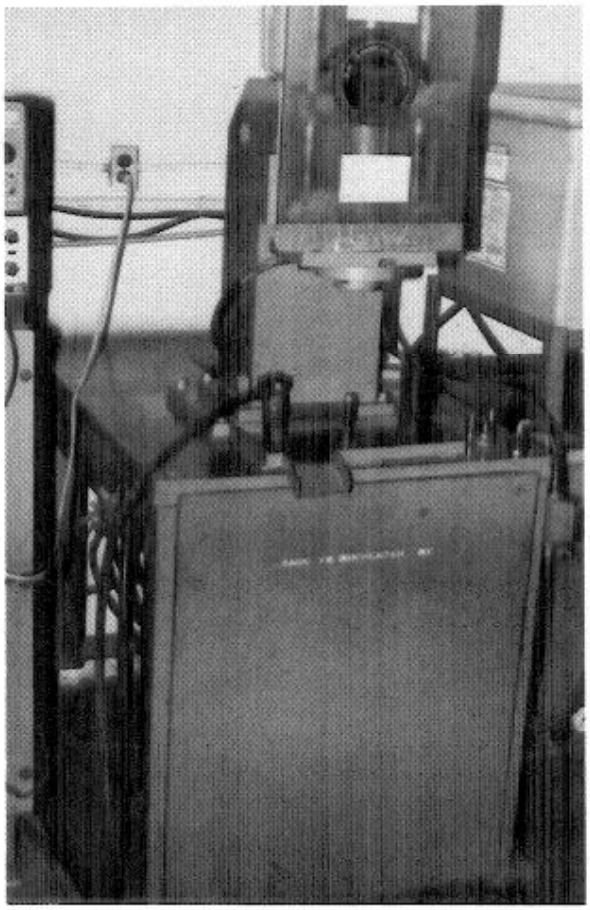
The process is not limited to rifling, but can cut a wide variety of complex shapes. Cation has recently finished an ECM unit for a major U.S. manufacturer of firearms to be used for final forming and finishing of the feed ramp and chamber mouth on 9mm and 45 caliber autos. (Cation isn't saying who, see if the ramps in the photographs look familiar). The resultant ramps are substantially smoother than current automated methods, and yet are more consistent than is possible with hand polishing.

In rifling, the process is only used to cut the grooves, leaving the top of the lands with a conventional surface. However, if the process can be used to produce smooth feed ramps, it could undoubtedly also be used to produce a smooth land. A more detailed evaluation of the process is planned as soon as a sample barrel is available for examination.

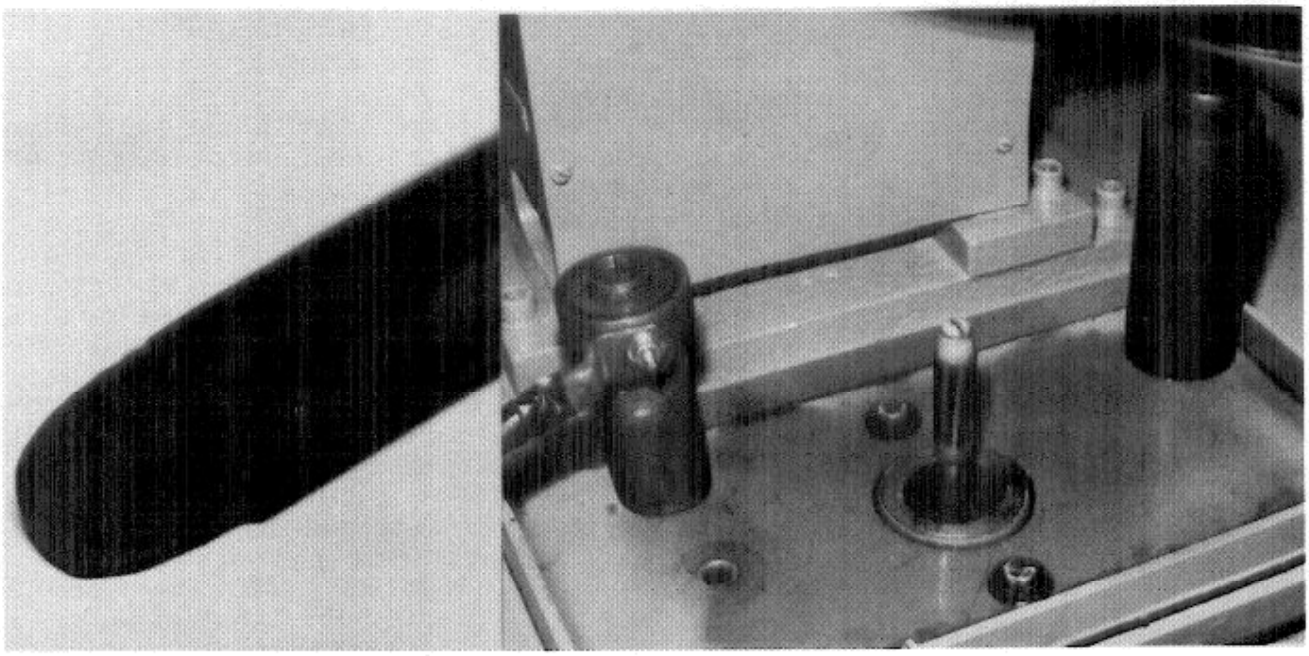
A CROSS SECTIONAL VIEW OF THE ECM BARREL RIFLING PROCESS



1. The barrel
2. The mandril
3. Plastic strips, which act as spacers and forms.
4. Void areas between the barrel and mandril through which the electrolyte is pumped. Metal is cut away from the barrel adjacent to this void to form the rifling grooves.

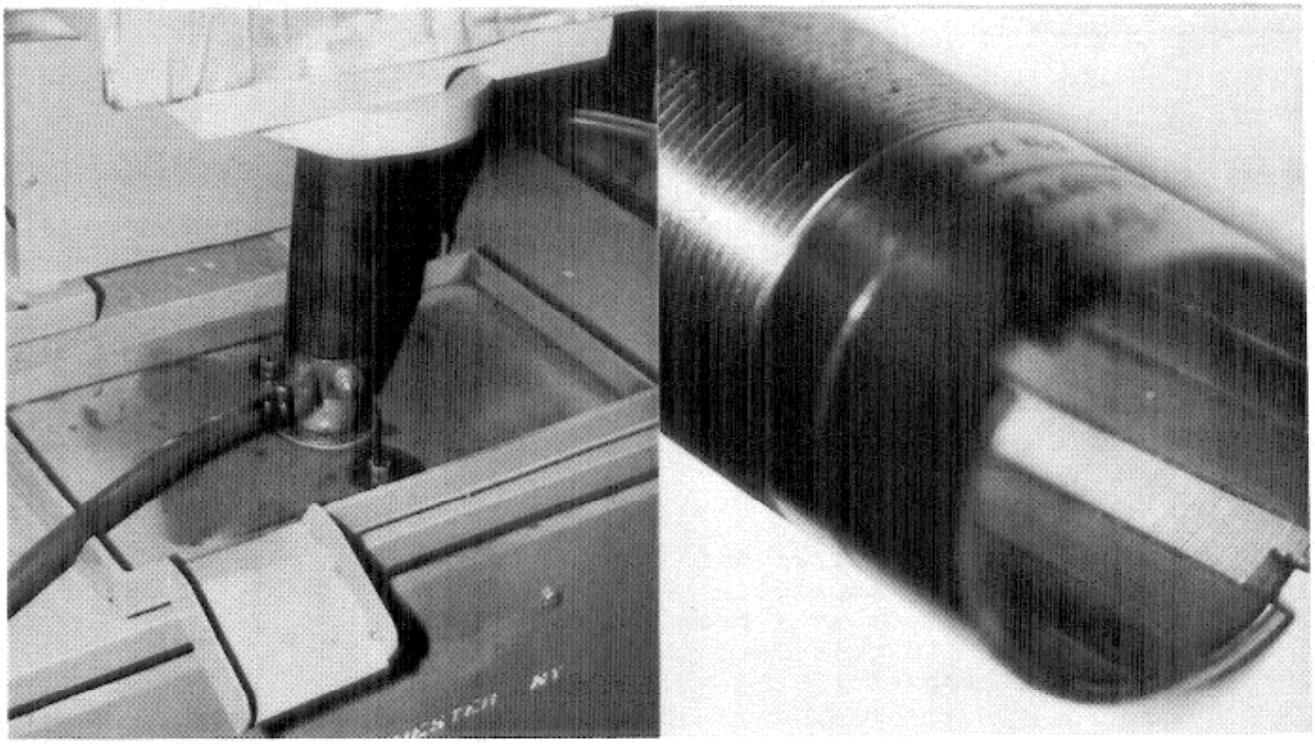


A stationary mandril ECM unit.



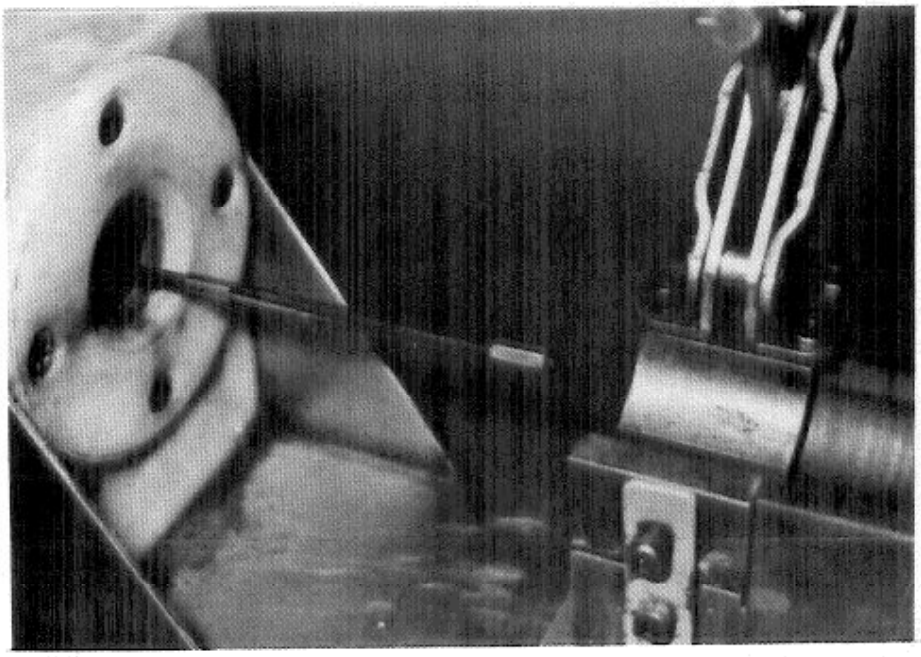
The brass mandril. The rifling grooves will be formed in the pattern of the exposed brass between the plastic strips.

The mandril installed on the ECM unit.

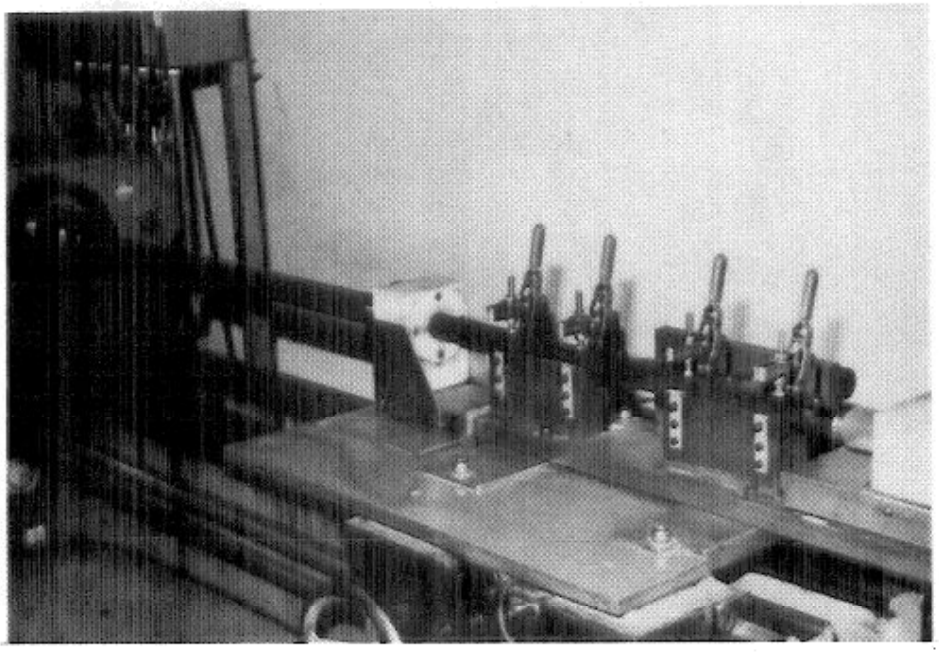


The ECM unit set up to form rifling on a shotgun choke tube.

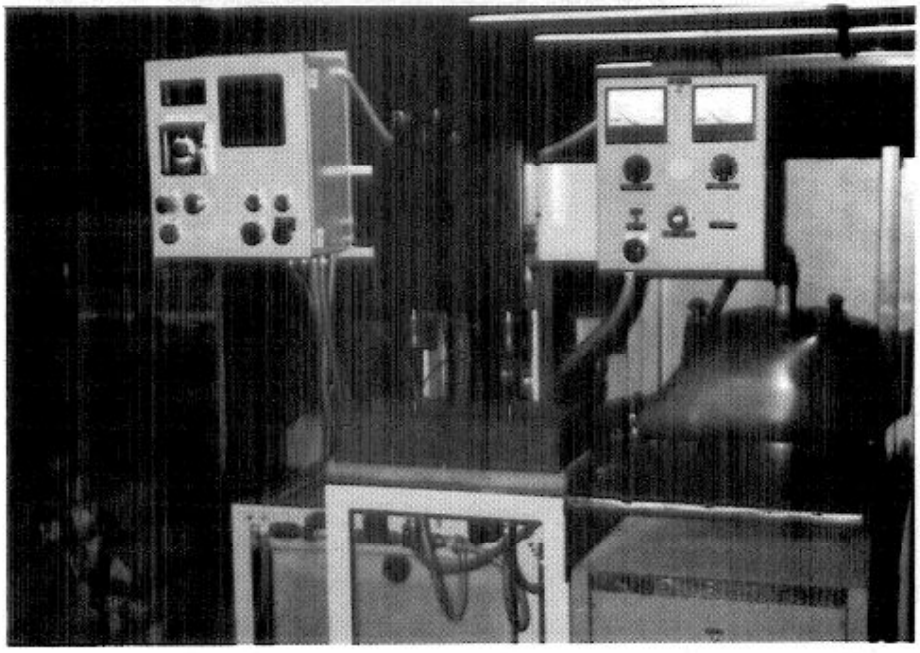
The finished shotgun choke tube rifled by ECM.



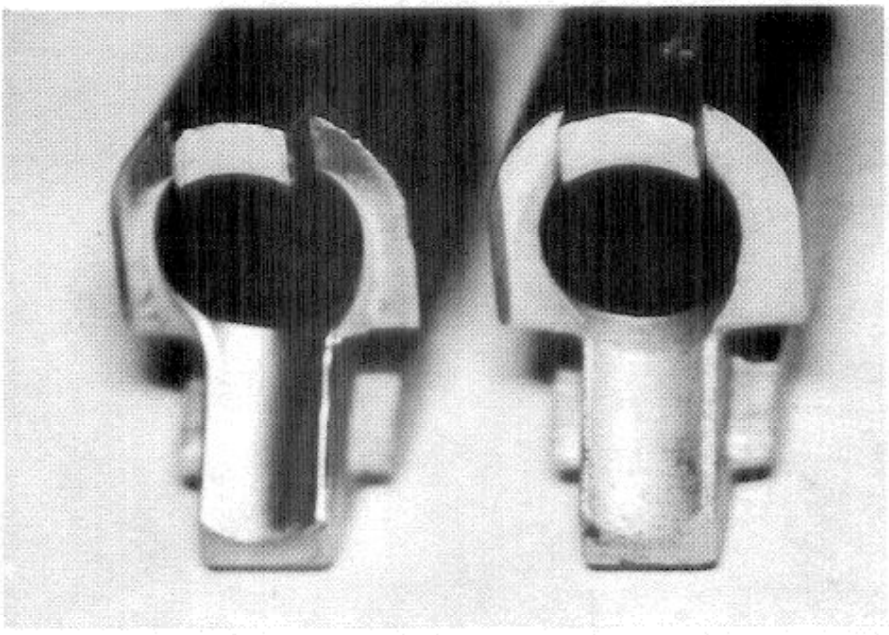
An ECM unit for long barrels. The barrel blank will be clamped into the fixture and the mandril will travel up the bore, rotating and cutting rifling as it moves.



The traveling mandril ECM unit with a barrel installed.



An ECM unit designed to finish the feed ramp and chamber mouth on auto pistols.



The feed ramp and chamber mouth of the left barrel is finished by ECM.