Supplemental Information & Instructions
for
031-247 (1A3698) SYNCHRO CONE
BN1 3 SPEED GEARBOX

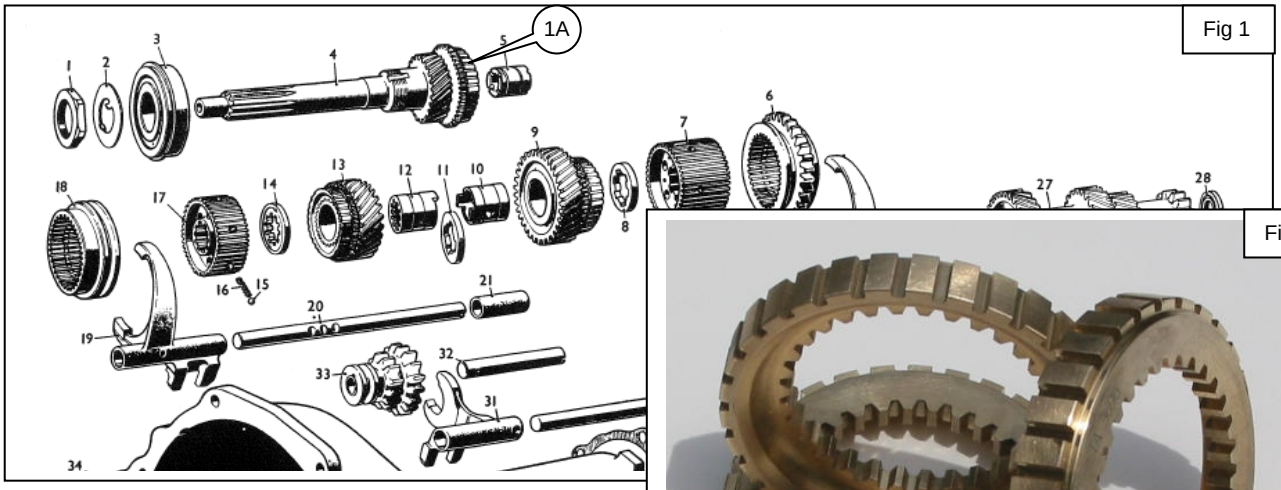

Fig 1

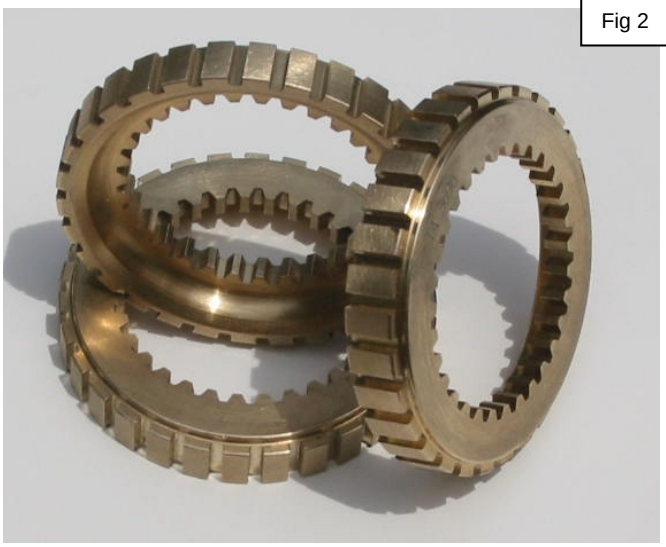

Fig 2

Photo Courtesy of Craig Rice

About this Synchro Ring

In this unique industry, small manufacturers often make components that larger firms cannot produce economically. In extreme cases, an individual enthusiast will undertake to produce a part that has limited potential sales. Some of these are extremely complicated. The BN1 synchro ring (1A) is such a product. Craig Rice began working on this project in 2004. He found a genuine new old stock synchro cone (Austin P/N 1A3698) and that was the key.

The original sample was reverse-engineered to create a master blueprint. Next step was to determine what the cone was made of. A microprobe analysis was conducted which revealed the metallurgical content. The original cone was found to be 87% Cu, 9% Al, 3% Fe, 1% Si & Ni. This aluminum bronze alloy is similar to AB1, AB2, AMS4635, C95400, and AMPCO 18. The new synchro cones (Fig 2) are AMPCO 18, which is 85.75% Cu, 10.5% Al, and 3.75% Fe. Once the metallurgical specifications were complete, effort turned to the metrics. A special broach bar had to be made to cut the uniquely British internal splines. Once the tooling was made, eighteen synchro cones were produced for evaluation. These prototypes proved to be slightly harder with better wear characteristics than the OEM synchro cone. Once satisfied that the synchro cones were correct in every respect, the first production run was made. These synchro cones are currently in use in a number of BN1s with absolutely no problems.

Installation

Workshop Manual: These cones (Fig 7, 2) are "shrunk on" to the first, second and third speed gears (actual) (Fig 7, 4), which are normally supplied as a complete unit for spares purposes. Where facilities exist for shrinking on and final machining, cones can be supplied separately. However, care muse be taken in fitting if the gear is to operate satisfactorily. On each gear the appropriate speed coupling adapter (Fig 7, 3) must be fitted before the cone, but there is no need to pre-heat this adaptor, which can be pressed home in the cold state. There is a shoulder on one side of the adapter, and this must be facing the gear and not the cone.

Craig: Each gear must be clean with 48-tooth coupling adapter (Fig 7, #3) installed on the gear (Fig 7, #4) with the chamfered leads pointing away from the helical gear teeth.

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INSTALLATION, from Workshop Manual, Gearbox, F/7, & Craig Rice

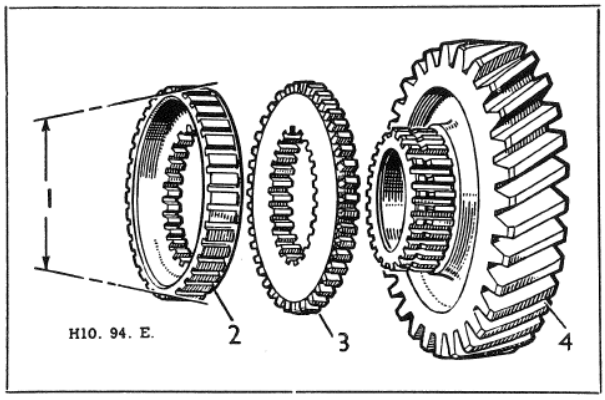


Fig. 7. Synchronising cone.
1. Chamfer to be machined after cone is shrunk into position. 2. Cone 3. Coupling adapter. 4. Constant mesh gear.

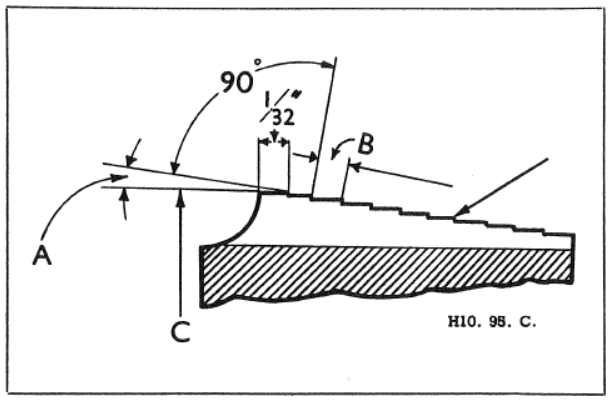
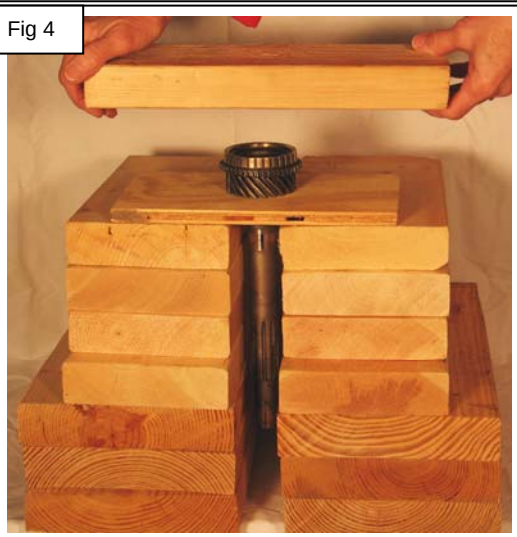


Fig. 8. Cone dimensions.
A. Cone angle 5° 10′. B. Coarse thread turned with ·015 in. lead. C. Cone diameter 2·5 in.

Workshop Manual: The internal broaching of the cone is calculated to allow for a shrinkage fit on to the gear serrations, and the cone must be heat-expanded before it can be fitted. When heated to approximately 250 degrees Fahrenheit, expansion will allow the cone to be pressed home on to the gear without damaging the broaching and will be sufficiently close fitting to resist displacement in gear changing. The heating can best be done by immersion in oil of 250 degrees Fahrenheit and then fitting by means of a hand press.
Craig: Cool the gear/coupling adapter assembly in a freezer at -10 to +10°F for minimum of 3 hours. Place the synchro cone in a preheated oven at a temperature of 290 to 300°F for minimum of 1½ hours. Second and third gear can be assembled using two short lengths of 2 x 4 lumber (Fig 3). The first motion shaft will require a braced support due to the shaft length (Fig 4). Do not attempt the assembly process until the parts have been heated or cooled for the specified length of time at the specified temperature. In an expedited manner, place the cooled gear on length of 2 x 4 or support. Quickly locate the heated synchro cone on the gear with the flat surface toward the coupling adapter. Press home using both hands and length of 2 x 4.
Workshop Manual: After shrinking on, the unit should be immediately quenched in water to prevent the heat softening the gear itself.
Craig: Immediately quench in water to prevent synchro heat from softening the helical gear. This will yield a 0.0015 press fit.
Workshop Manual: When the cone is in position, the final machining can be done in accordance with the dimensions given in fig. 8. The taper of the cone must be true and concentric with the bore to .001 in.
This is not a trivial undertaking. It must be done by a competent machinist that understands the drawing in Fig. 8, and is capable of doing the job to the specified tolerance.

Fig 3

Fig 4



Photos Courtesy of Craig Rice

Craig: Machining the Cone and Tolerances
To machine the cone I use a 0.018 cut off tool, which is easy to grind at a machine shop.
Figure 8 in the service manual give some absolute dimensions without tolerances. To determine the tolerances, six NOS gear assemblies- two 2nd gears, two 3rd gears, and two 1st motion shafts- were inspected using Figure 8 in the Service Manual as a reference. The following tolerances were obtained from the six gear assemblies:
A Cone Angle ranged from 4 degrees, 53 minutes to 5 degrees, 21 minutes. Spec is 5 degrees, 10 minutes.
B Coarse thread lead ranged from 0.015 inches to 0.022 inches. Spec is 0.015 inches.
C Cone Diameter ranged from 2.497 to 2.504 inches. The new synchros are 2.538 to 2.540 inches so tranny builders can custom fit each synchro cone.