An Improved Nuclear Magnetic Resonance Spectrometer

The problem:
To accomplish a high degree of nuclear stabilization of a nuclear magnetic resonance (nmr) spectrometer for low gyromagnetic ratio nuclei in a simple, straightforward manner. Such stabilization has previously been possible only through a complicated nmr system employing frequency synthesis.

The solution:
A device in which a sample of a reference substance is placed in a container that is slipped over presently used nmr receiver inserts. The transmitter excites the nuclei in this container external to the coil windings and the nuclei induce a signal in the signal coil of opposite phase to that of nuclei in a sample container inside the receiver coil winding.

How it’s done:
A cylindrical sample container is placed coaxially about the common nmr insert as shown in the left figure. A reference sample in such a container has a sufficiently homogeneous field to give a signal suitable for locking the field and frequency of an nmr spectrometer with a simple audio modulation system of a type widely in use. Spectra of $^{14}$N, $^{13}$C, $^{11}$B, $^{31}$P, $^{19}$F, and $^1$H are successfully recorded when the spectrometer is stabilized on a sample of the corresponding nucleus in such a sample container external to the
receiver coil. Resolution of the order of 0.2 to 0.4 cps is achieved for N\textsuperscript{14}, C\textsuperscript{13}, B\textsuperscript{11}, and P\textsuperscript{31}.

Notes:
1. The ultimate in design to increase the field homogeneity at the sample and reference would be a one-piece insert with the receiver coil wound inside as shown in the right figure. The problems concerning such a design are under study, the winding and placement of the coil being the greatest at present.

2. Inquiries concerning this innovation may be directed to:
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Patent status:
No patent action is contemplated by NASA.
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