chess columns of newspapers — such an approach might be able to improve the quality and to reduce the costs of chess literature.

Editor's note: The gray font referred to here is normally used to test METAFONT proof characters — it is the font that appears in the character illustrations in Volume E of *Computers & Typesetting*. Unlike ordinary METAFONT fonts, the gray font is device-dependent. That is, different versions, *with different* .TFM *files*, will be used to produce output on devices with different print characteristics, including resolution.

Dr. Appelt originally prepared this article using a laser printer with 300 dots-per-inch resolution; the typesetter on which TUGboat camera copy is prepared has a final resolution of over 1000 dots per inch, although fonts for it are created at 723 dots per inch. Attempts to install a suitable typesetter-specific gray font failed, so the figure of the chessboard has been pasted in from the laser printer copy that Dr. Appelt supplied.

Anyone attempting to use the macros defined in this article, or doing anything else that requires the gray font (including METAFONT), should be aware of this restriction.

Equation Numbering in Plain TeX

J. E. Pittman

A few simple macros can provide facilities for automatic equation numbering with (limited) forward referencing. A backward (after the equation has been displayed) reference to an equation is made in the text by the use of the \referenceequation{*name*} macro, which generates the appropriate number and inserts it into the text. The \referenceequation macro will also work correctly if it is used 'just' before the referenced equation, i.e., as long as there are no numbered equations between the referenced equation and the point of reference.

A forward (before the equation has been displayed) reference to an equation is made by the use of the \forwardreferenceequation{*name*}{*n*} macro, where *n* is the number of numbered equations that will be displayed between the point of reference and the referenced equation.

Within displayed equations, the \eqname{*name*} macro can be used in same manner that the

\eqno *text* macro is normally used. Note: \eqno is documented in chapter 19 of The TeXbook.

If an equation is to be numbered but not referenced, the \eqnum macro can be used in place of the \eqname{*name*} macro.

Figure 1 gives an example of the way in which these macros are normally used.

This method of equation numbering is limited due to the requirement of equation counting for forward referencing, however, it works well for most applications and does not require more than one pass through the input file(s).

The following input:

```
% --- example ---
Equation \forwardreferenceequation{byhalves}{2}
gives a simple example of a convergent
infinite series.
$$
E = mc^2        \eqname{emc2}
$$
$$
A = A           \eqnum
$$
$$
1 = \sum_{n=1}^\infty 2^{-n}
  = {1 \over 2} + {1 \over 4} +
    {1 \over 8} + \cdots    \eqname{byhalves}
$$
\TeX\ reduces the task of typesetting
Einstein's famous equation
(\referenceequation{emc2}) to pure
simplicity.
\par
```

Produces:

> Equation 3 gives a simple example of a convergent infinite series.
>
> $$E = mc^2 \qquad (1)$$
>
> $$A = A \qquad (2)$$
>
> $$1 = \sum_{n=1}^{\infty} 2^{-n} = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots \qquad (3)$$
>
> TeX reduces the task of typesetting Einstein's famous equation (1) to pure simplicity.

Figure 1.   Example of equation numbering macro use

```
% --- macros ---
%
\newcount\equationnumber       \equationnumber=0
%
\def\eqnum{\relax
    \global\advance\equationnumber by 1
    \equationnumberformat{\the\equationnumber}%
    }%
%
\def\eqname#1{\relax
    \count255=\equationnumber
    \assignnumber{EN#1}\equationnumber
    \global\equationnumber=\count255
    \global\advance\equationnumber by 1
    \ifnum\csname EN#1\endcsname=\equationnumber
    \else
        \message{The equation number for ''#1'' is incorrect!}%
    \fi
    \equationnumberformat{\csname EN#1\endcsname}%
    }%
%
\def\equationnumberformat#1{\eqno(\equationnumbertype{#1})}%
%
\def\equationnumbertype#1{\number#1\relax}%
%
\def\referenceequation#1{\relax
    \assignnumber{EN#1}\equationnumber
    \equationnumbertype{\csname EN#1\endcsname}%
    }%
%
\def\forwardreferenceequation#1#2{\relax
    \global\advance\equationnumber by #2
    \assignnumber{EN#1}\equationnumber
    \global\advance\equationnumber by -1
    \global\advance\equationnumber by -#2
    \referenceequation{#1}%
    }%
%
% Macro for numbering, parameters are the csname text and a counter.
%
\def\assignnumber#1#2{\relax
    \ifnum0<0\csname#1\endcsname
    \else
        \global\advance#2 by 1
        \expandafter\expandafter\expandafter
              \xdef\csname#1\endcsname{\the#2}%
    \fi
    }%
```

Figure 2.   Listing of the macros for equation numbering