MLM-2310

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Semiautomatic MDF Deburring Tool

W. L. Simonton

March 31, 1976

Research and Development Report

MOUND LABORATORY
Miamisburg, Ohio
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Abstract

A device for semiautomatically deburring the ends of lengths of MDF (mild detonating fuse) was developed by the Automation Development group at Mound Laboratory. The device performs the deburring function by cutting a 0.002 in. x 0.002 in. chamfer on the MDF with small rotating blades. This air-operated, semiautomatic device provides improvement over the manual method of removing burrs by reduction in time and operator strain. A time study is underway to determine the time saved which is expected to be about 75%.

Introduction

A semiautomatic machine for cutting MDF* to specific desired lengths was designed, fabricated, and developed at Mound Laboratory. This cutting process was highly successful in producing close tolerances and smooth quality cuts. However, the process left tiny burrs around the periphery of the MDF metal sheath. These burrs are also encountered in the manual cutting of MDF. Initially they were removed with surgical scalpels, which was tedious and time-consuming. Later, small, hand-held deburring tools (Figure 1) were developed which employed modified, hand-shaped Exacto blades to cut a 0.002 in. x 0.002 in. chamfer on the ends of the MDF parts. With properly adjusted sharp blades, these tools did a respectable job of deburring, although they too had drawbacks. The soft MDF was easily bent or twisted while it was being inserted in the tool and the tool was rotated to chamfer. Short blade life and the great effort to modify and position new blades in the tools for optimum chamfering were also problems. There was obviously still much room for improvement in the deburring process. To obtain this improvement, a project was undertaken to develop an advanced version of the chamfering tool with semiautomatic operation. Improvements desired from the advanced design included a smoothly cut finish on the chamfer, elimination of off-center chamfers, elimination of twisting of MDF, prolongation of blade life, and easier blade adjustment and replacement.

*MDF - mild detonating fuse, which is a continuous thread of explosive contained in a metal sheath.

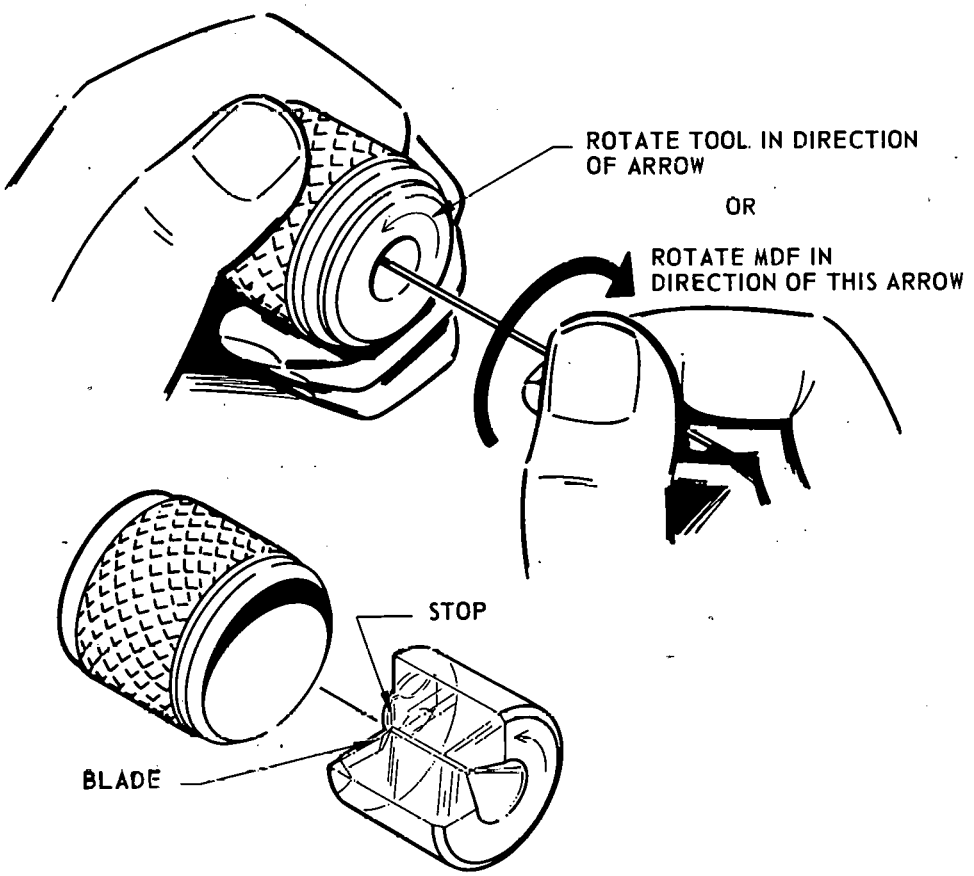

FIGURE 1 - Small hand-held tools replaced the use of surgical scapels to remove burrs from MDF.

Description and Operation

The semiautomatic device that resulted from this development project consists of a heavy base, a housing, and a rotor holding a pair of custom ground high speed steel cutter blades. The device is shown in Figures 2, 3, and 4. The rotor has buckets milled into its underside for air impingement drive and is mounted on a pair of matched duplex angular contact bearings. A tube extending through the top of the housing provides a guide for the precise positioning of the MDF workpiece against the blades and a stop pin controls the extent of contact. The rotor is operated with air at 80 psig pressure.

The operating principles of the advanced design can be understood by studying Figure 3. The operator inserts the end of the MDF workpiece into the stationary guide, gently feeds it in until it touches the stop pin, and then stops feeding. He holds it in this position for one or two seconds and then gently pulls it out of the guide. The chamfering is complete, having been accomplished by the rotating cutter blades trimming the sheath of the MDF while it is against the nonrotating stop pin. The stop pin is smaller in diameter than the MDF workpiece; therefore the circumference of the MDF hangs off of the pin, and allows the blades to be sufficiently close to chamfer the MDF. The lightness or heaviness of the chamfer is regulated by the position of the adjustable blade mounting blocks which are controlled by set screws. (See Figure 4)

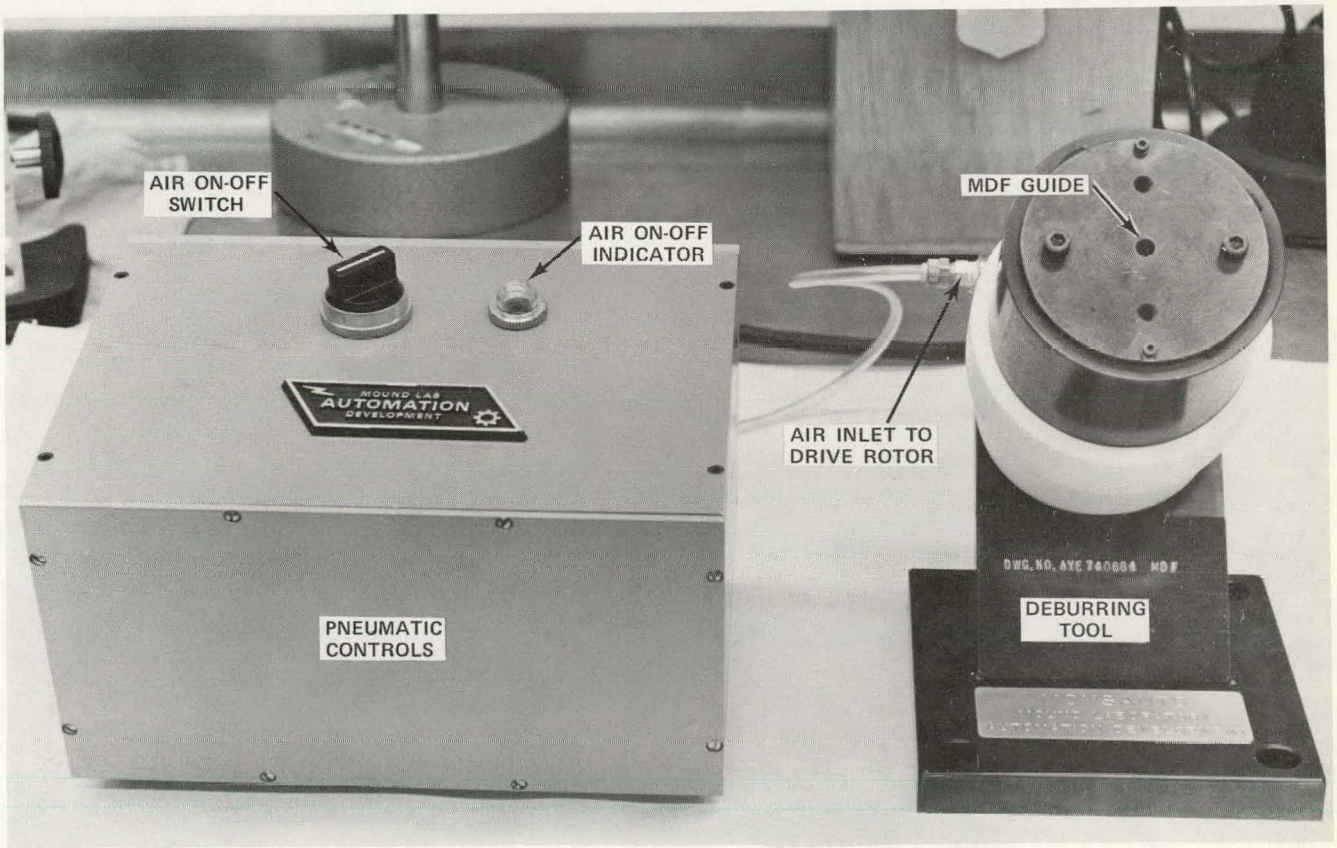

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FIGURE 2 - Operator's view of the deburring tool with its ancillary pneumatic controls.

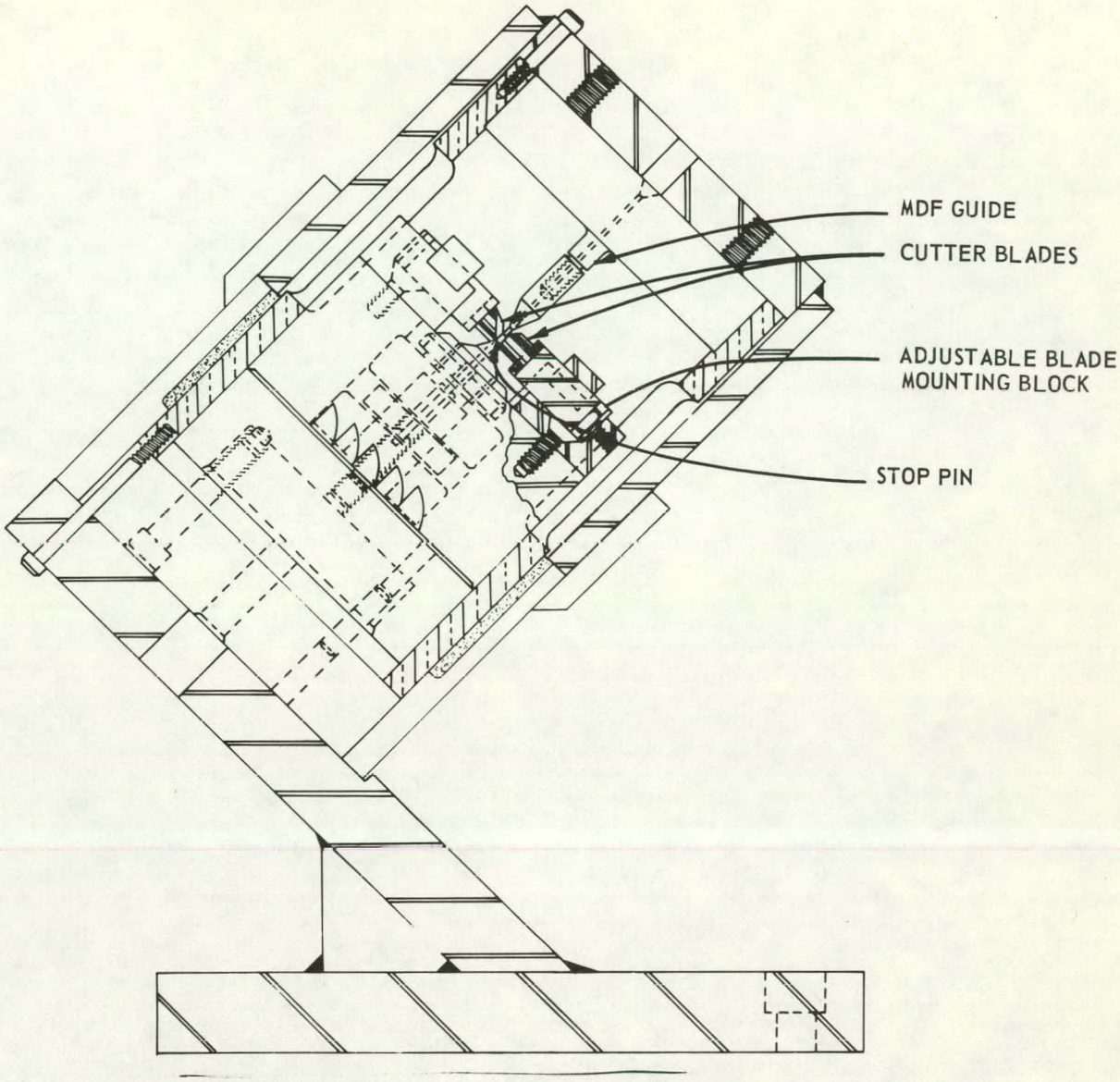

FIGURE 3 - A cross-section of the semiautomatic deburring tool shows major components of the design.

Discussion

During the development of this device, the importance of several design factors became obvious. For instance, the central axis of the MDF guide must be coincident with the axis of the stop pin and the axis of rotation of the blades. If not, the chamfer will not be concentric to the longitudinal axis of the MDF. The blades may totally miss chamfering on one side of the workpiece and may cut into the core material on the other side. Misalignment between the MDF and the blades may also cause whipping of the MDF. This may be avoided by extending the MDF guide as close as possible to the blades and permitting a minimal amount of MDF to stick out of the guide.

The developmental work on cutter blades was another important aspect of producing a device that could cut a smooth chamfer around the small perimeter of the MDF. The blades were designed and ground at Mound Laboratory especially for this device. High speed steel was chosen as the material for the blades. In development, various cutting angles and reliefs were ground onto a set of blades and then

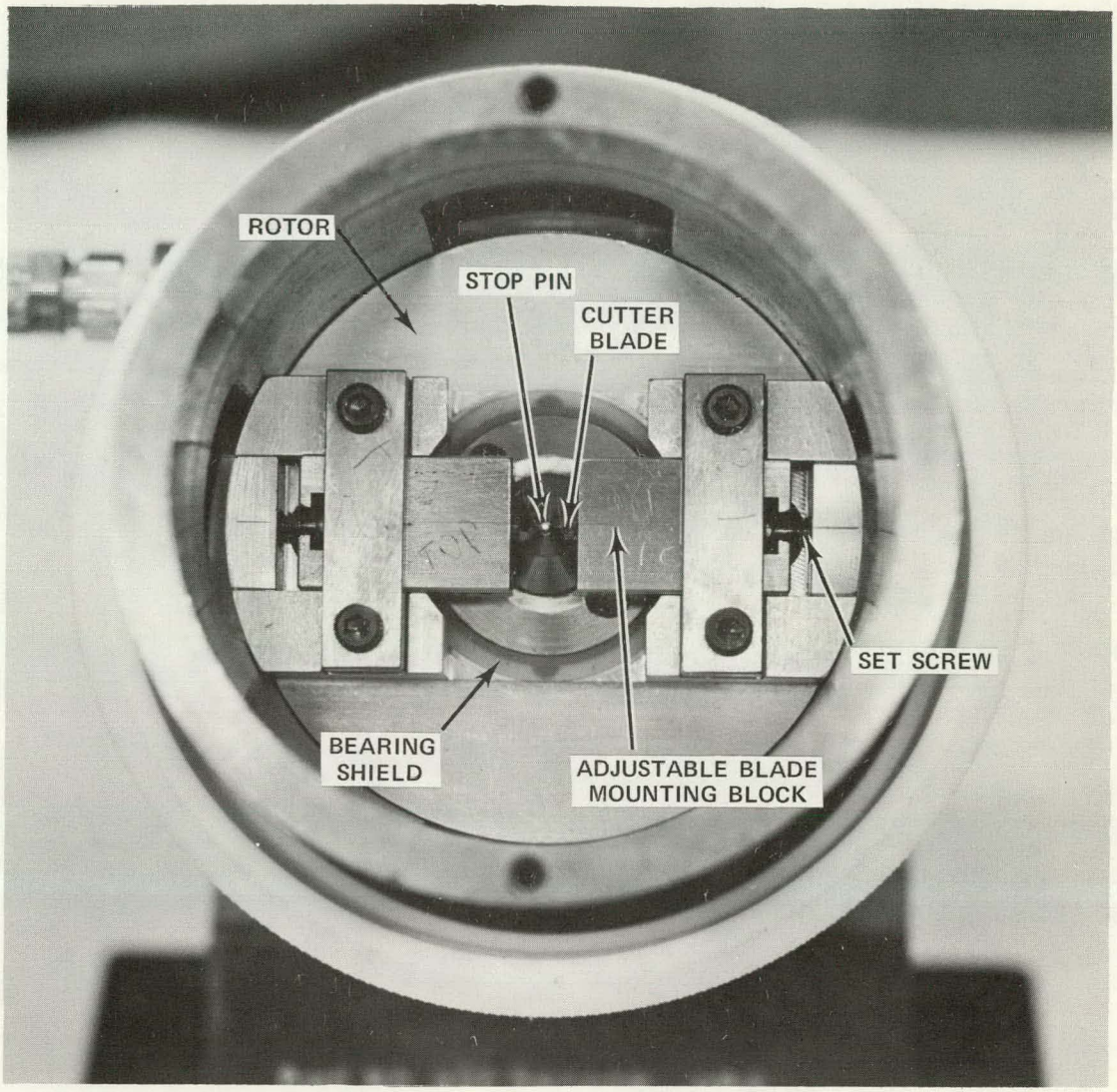

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FIGURE 4 - Internal view of deburring tool shows adjustable blade mechanism.

tried at chamfering. Improvements and modifications were then made until a workable set of blades was obtained. A sketch of these blades is presented in Figure 5, which shows how they contact the MDF.

It can be seen that Blade One cuts on a steeper angle (1) with respect to the centerline of the MDF than does Blade Two. This design eliminates burrs. If both blades cut on the same angle burrs are generated at both the top and the bottom of the chamfer. By setting the blades at slightly different angles, Blade One eliminates the burr on top, and Blade Two eliminates the burr on the bottom. Sharpness on the cutting edges was also found to be a must. These blades can be resharpened and readjusted as the need may rise. A blade grinding fixture was also fabricated and used to grind blades, and can be used to grind replacement blades. This blade grinding fixture, which is shown in Figure 6, is made so that the adjusting block that holds the blade may be clamped onto the fixture in milled slots and thus the blade will be positioned properly with respect to the grinding wheel for each surface to be ground.

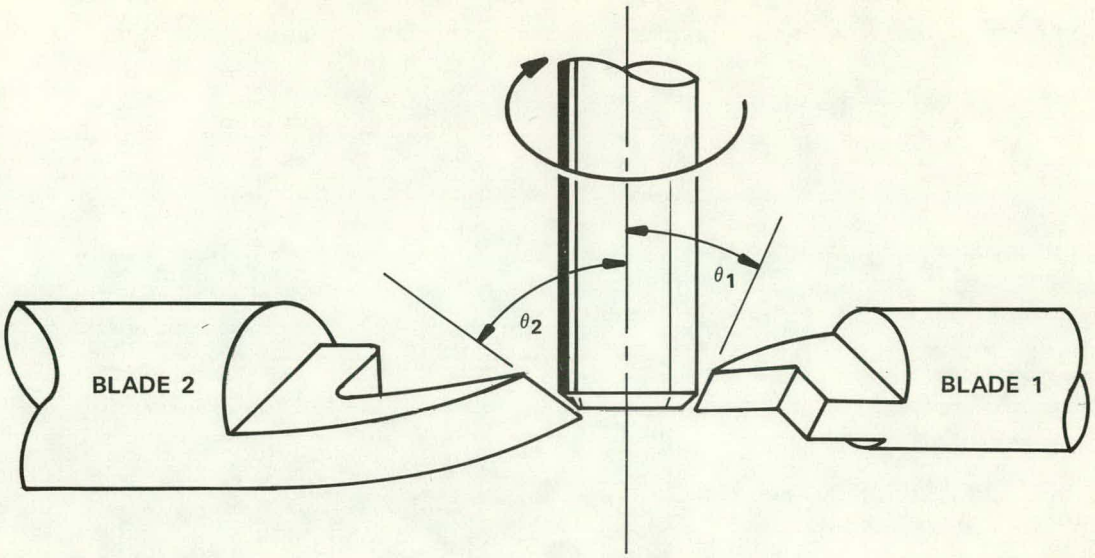

FIGURE 5 - Two blades at different angles eliminate burrs at top and bottom of chamfer.

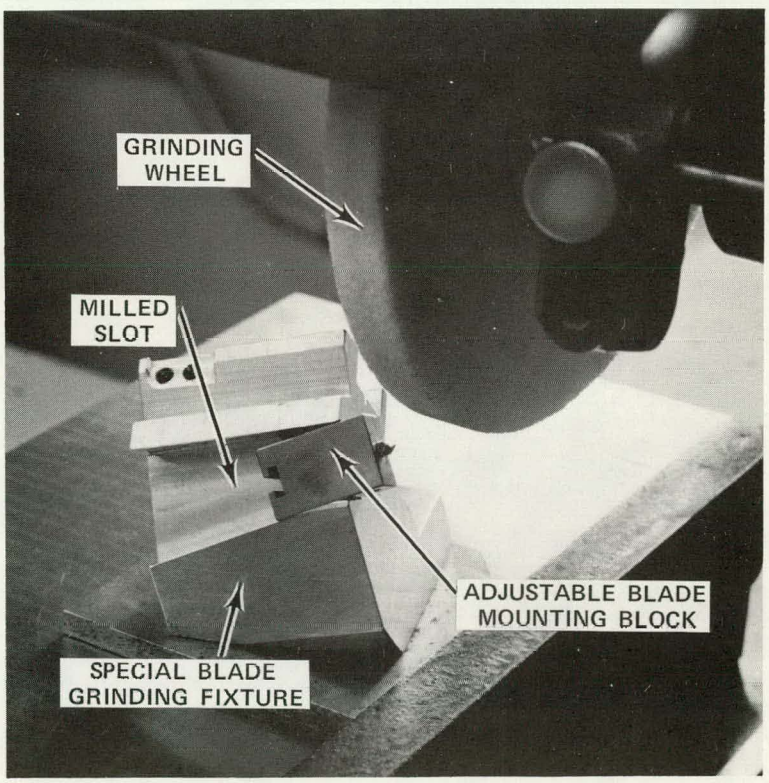

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FIGURE 6 - The blade mounting blocks are clamped to a special fixture for rapid grinding of each blade surface.

Summary

A semiautomatic MDF deburring tool was developed which has the capability of removing burrs efficiently and cleanly. In operation, it cuts a 0.002 in. x 0.002 in. chamfer on the MDF sheath. It affords improvement over a hand-held deburring tool in producing smoother finishes on the chamfer, eliminating off-center chamfers, eliminating twisting of MDF, prolonging cutter blade life, and facilitating blade adjustment and replacement. It provides an estimated time saving of 75% over the original manual method of deburring with a scapel and eliminates considerable operator eye and mental strain. Moreover, it requires a significantly lower level of operator skill than does the scalpel method.

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