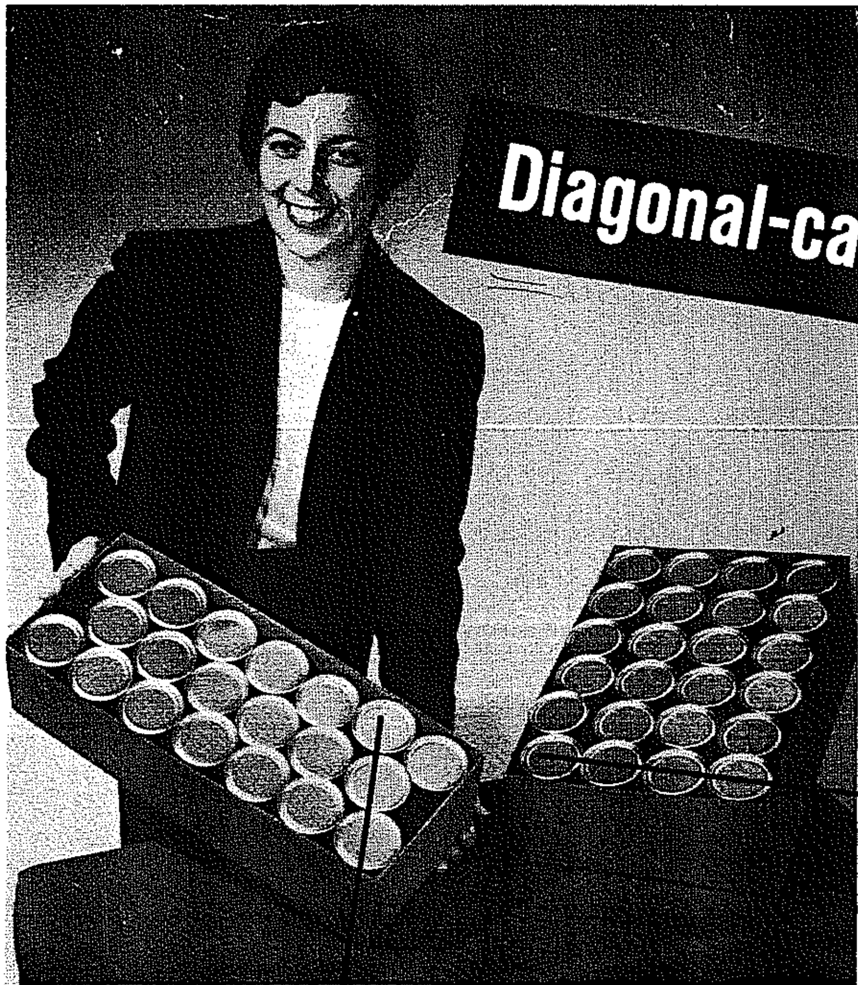
R58-32

Diagonal-casing: why not?



24-CAN RIGHT ANGLE

20-CAN DIAGONAL

Easy-to-handle 20-can carry case for beer suggests a way the diagonal-pack principle can lead to bigger multiple sales at retail level. Compare space savings in slim 20-can case with conventional 24-can shipping container at right.

Quartermaster studies show that staggered-row case packing of cans can reduce container cube by 4.6% and save up to 4,000 sq. ft. of boxboard per carload of product. Here are pros and cons

*By Joseph P. Akrep**

There's brand-new interest—stimulated by the potentials of boxboard cost savings and shipping economies—in the technique of case packing of metal cans and other cylindrical containers and products in a diagonal pattern. (At least three major U. S. packagers, including General Foods, are evaluating the method for possible future application.)

Recent experimental research, conducted by the U.S. Army Quartermaster Food & Container Institute, reveals these significant advantages for diagonal case packing compared with the standard right-angle packing method:

1. Cube efficiency rating 4.6% better, which means less waste space in each case and considerable total space savings in shipping, warehousing and retail-storage shelf stacking. The reduced cube offers significant freight savings as well, because more goods may be shipped in the same amount of space.

2. Savings of up to 4,000 sq. ft. of boxboard per rail carload—an obviously important monetary consideration to all packagers.

Translating the QMFCI findings for the military into commercial applications, the diagonal-packing method could mean an over-all saving of $8,000,000 a year for packagers.

There are two problems—neither of which appears to be insurmountable—in the diagonal-packing technique. First, cans cannot be packed in lots of one or two dozen, which represent the basis of traditional pricing structures. Second, adoption of the technique will require conversion of existing case-loading machinery to produce diagonal patterns at high speed.

The Quartermaster Corps' exploration of the possibilities of diagonal case packing was spurred by

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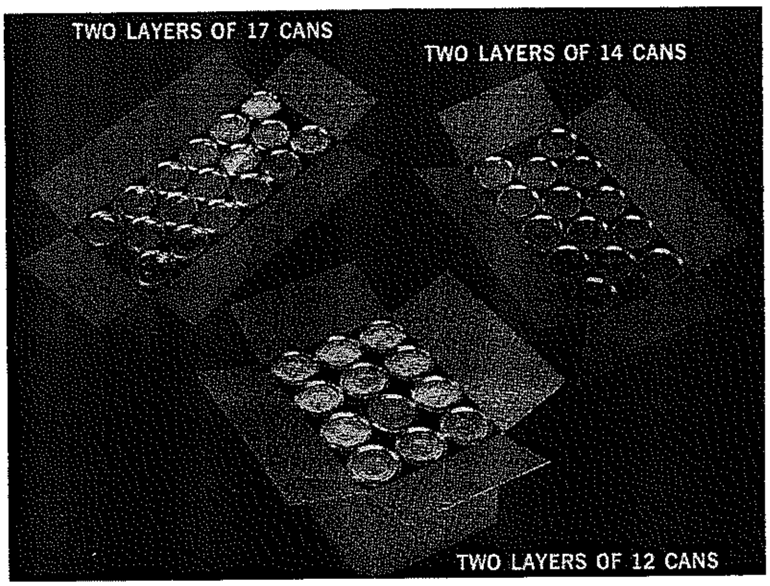
the military's ever-present need to find means of reducing shipping-case tare weight and cube—particularly for large-scale aerial resupply in any future military operations.

It was found that case packing of foods in cylindrical cans is a typical example of a packaging method with a high cube loss. Whether packing 12, 24, 36 or 48 cans to a shipping container, the standard method of right-angle patterns means a constant space waste of 21.5% due to voids between cans.

Substitution of 20- and 28-can single-layer diagonal patterns for the standard 24-can right-angled layer revealed a 4.6% savings in cube, with commensurate savings in boxboard required to make the case. An examination of cases packed by both methods shows far less waste area between cans in the diagonal pack. The break-even point occurs when the internal gains due to the diagonal pattern exceed the losses caused by the end voids.



Better cube efficiency through diagonal case packing is dramatized in this photo. In standard right-angle, two-layer pack of 24 cans (bottom), the void between cans causes a space waste of 21.5%. In diagonally packed, two-tier cases of 34 and 28 cans, snug fit of staggered rows saves 4.6% in cube and offers obvious economies in boxboard.

Except for very large cans, such as No. 10, it is possible in each instance to design at least one diagonal pattern which will be more efficient than the standard pattern. Most can sizes are adaptable to several possible alternatives.

Table I on p. 97 shows comparative data for typical containers and indicates the dollar savings in boxboard that can be expected by using diagonal packs to replace standard right-angle packs. The largest saving (20%, or about 4,000 sq. ft. of fibreboard per carload) is obtained with No. 3 cylinder cans in a one-layer, 20-can pack. It amounts to $181 in V3s fibreboard per carload in addition to a 4.6% saving in space requirements.

It should be noted that the savings as shown in Table I are based on the standard top-loading carton. Basing the computations on such other types as the end-loading carton would result in similar economies, since the cube saved does not depend on the type of carton used and is in addition to any material savings in carton construction itself. (It has been estimated that end-opening cases use 15% less board than do other cases[1].)

When the product being case packed is of such low density that the railroad car cannot be loaded to maximum permissible weight (toilet tissue, for example) with standard right-angle-packed cases, additional savings in freight costs are possible through diagonal packing. Because the density of the diagonally packed case as a unit is increased, it is possible to get a greater load into the car without regard to the weight factor. This is roughly the equivalent of releasing one railroad car in 20.

The magnitude of the tonnage handled in cylindrical cans—and therefore the potential savings—is not generally appreciated. Data for 1956 indicate that 350,000 carloads of food were shipped in cylindrical cans, of which 15% to 20% were military purchases. The average of the savings figures from Table I on p. 97 is more than $73 per rail car. If a savings of $15 per carload is assumed as a conservative figure (including items which cannot be handled in a diagonal pack), it means a $1,000,000 saving in boxboard for the Department of Defense on military purchases of canned goods alone, exclusive of the value of the space saved. When applied to the national economy as a whole, the estimated value of boxboard savings is more than $8,000,000 a year—again including the 4.6% space saving.

The improved cube efficiency which results from diagonal packing is most impressive when comparisons are made on a large-quantity basis. For example, a 4.6% savings in cube translates into 46 pallet loads per 1,000—important to both packagers and the military.

Several factors should be evaluated to determine the possibilities for commercial application of the diagonal-pack principle. These include strength of the loaded case and the effect of the method on existing machinery and on established customs, as well as retail distribution problems.

Laboratory tests conducted at the Quartermaster Food & Container Institute reveal substantially simi-

[1]See "End-Loading Can Caser," Modern Packaging, March, 1958. p. 132.

lar performance characteristics between standard and diagonally packed shipping containers. However, the highly promising performance of heavier diagonal packs indicates that the pattern may make for a stronger and more resisting load within the case and supports the walls more efficiently.

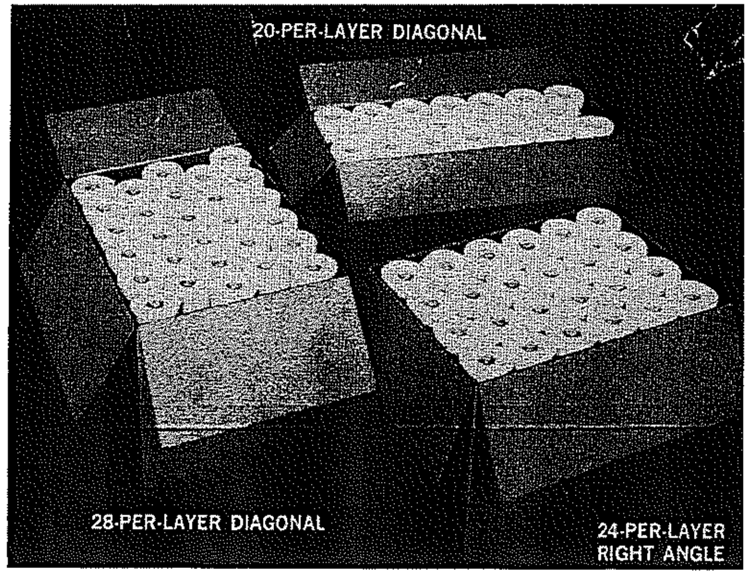
The only change that will be necessitated on packaging-line machinery concerns the caser. However, it is believed that many casers will simply require modification. (One packager contemplating use of the diagonal pack reports that conversion of his present casing machinery can be accomplished quickly by the addition of a few relatively inexpensive parts.)

The main problem to be anticipated in any general shift from standard to diagonal case packing is its effect on trade customs—particularly the change in number of cans per case. The whole pricing system is based on a "per dozen" or "per case" quotation for a definite size of pack. It remains to be seen how important such a system really is in this age of supermarkets, in which the exact number of cans per case may be irrelevant as long as it is the most economical pack. It may also be desirable, in view of the quantities sold in such outlets, to base quotations on a "per 100" basis, which might make billing and retail pricing simpler. Some items, such as paper towels and toilet tissue, already have been converted from the dozen pack to cases of 50 or 100.

Since family purchases generally are limited to two or three cans of any one item, consumer acceptance is not a factor in determining number of cans per case. One notable exception is canned beer, for which the six-can carry carton is highly popular. However, the six-pack tends to set an upper limit on the quantity purchased. Beer packaging thus might profit by the introduction of a diagonal 20-can pack to fill the gap between the six-pack and the 24-can case. Because of its smaller cross-section and lighter weight, the diagonal 20-pack is a much easier carry-home item than the 24-can case.

One of the can sizes omitted in Table I on boxboard savings is the No. 202, used for such products as baby food, tomato paste and juice. These cans, as well as small cylindrical jars for mustard, olives and other high-volume products, offer the greatest economies in diagonal case packing.

According to industry sources, normal packing for such items is 24, 48 or 72 cans per case. Because of their light individual weight, however, a 96-can pack is feasible. Unlike the larger can sizes, where no direct comparison between casing methods can be made, these smaller cans can be loaded either in a 96-can standard or a 96-can diagonal pack. In this size, cube saving is increased to 7.5%, compared with 4.6% obtained with the larger cans. In other words, the space ordinarily required to stock 12 cases will now hold 13 cases.



Lightweight products, such as toilet tissue, promise big savings in shipping costs when case is packed by diagonal method. Since railroad cars cannot possibly be loaded to maximum weight with items of this type, the narrower, higher-capacity, diagonal packs (left, upper right) make it possible to put a greater load into the same amount of space.

In general, cylindrically packaged products of any industry can be case packed by the diagonal method. The pharmaceutical industry, for example, packs an enormous number of vials, tubes and jars. Also, any cylindrical product can be diagonally packed.

Adoption of the diagonal-pack principle probably will be the result of a gradual tailoring of the method to products for which its use will be most advantageous. Packagers to whom the savings are most immediately obvious will adopt it most readily. The main criteria—as always—will be competitive advantage and increased efficiency.

Table I: Savings in boxboard cost by diagonal case packing of typical can sizes

	Dollar savings in rail carloads		
Can size and case-packing pattern	*200-lb.*	*V3c*	*V3s*
Beer can (211 by 413)			
Standard (2 layers, 24 each)	—	—	—
Diagonal (2 layers, 20 each)	$8.02	$13.63	$18.45
Diagonal (3 layers, 20 each)	53.46	90.88	122.96
Diagonal (2 layers, 28 each)	15.10	25.67	34.73
No. 3 cylinder (404 by 700)			
Standard (1 layer, 12 cans)	—	—	—
Diagonal (1 layer, 17 cans)	68.98	117.27	158.65
Diagonal (1 layer, 20 cans)	78.90	134.13	181.47
No. 2½ (401 by 411)			
Standard (2 layers, 12 each)	—	—	—
Diagonal (1 layer, 20 cans)		No savings	
Diagonal (2 layers, 14 each)	31.36	53.31	72.13
Diagonal (2 layers, 17 each)	51.22	87.07	117.81
No. 2 (307 by 409)			
Standard (2 layers, 12 each)	—	—	—
Diagonal (2 layers, 14 each)	32.22	54.77	74.11
Diagonal (2 layers, 17 each)	52.10	88.57	119.83
Diagonal (2 layers, 20 each)	69.20	117.64	154.16