Durability Tests Of Stainless Steel Hospital Utensils

By Arnold H. Dodge, B.S.

THE CIVILIAN HEALTH Requirements Program of the Public Health Service is seeking to determine whether hospital items made from non-nickel chrome steel (known usually as type 430 or type 17, containing about 17 percent chromium) are as durable as items made of the conventional chrome nickel stainless steel. Should the lack of nickel sufficiently impair the wearability of such items, it would be poor economy to deprive these items of that metal. The amount of nickel used in the hospital items is trivial when compared with total consumption. On the other hand, there is no point in continuing to use a strategic metal if such use is demonstrably extravagant and unnecessary. To determine whether or not nickel should be allocated to hospital items under a nickel control plan, it seemed desirable to obtain durability test information.

Stainless steel is essentially an alloy of iron and chromium. Nickel and other elements are often added to improve workability and to add corrosion resistance that will withstand special or unusually severe conditions.

For more than 20 years, certain articles of operating room furniture and hospital utensils in common use have been fabricated from a chrome nickel stainless steel, known usually as type 302 or 18-8 and containing about 18 percent chromium and 8 percent nickel. There has been a chronic countrywide shortage of nickel for most of this period. During World War II and the Korean emergency, supplies of nickel fell far short of demand, and controls were established to cover essential military needs. Nickel has recently become more important to the national defense because of the wide application of this metal in the field of atomic energy and specialized military activities. Logically, it is mandatory that the use of nickel be restricted to essential commodities during periods of war. Whenever possible, however, nickel-free alternates to the products affected by conservation orders should still be useful for economic reasons.

Mr. Dodge is a senior pharmacist assigned to the Civilian Health Requirements Program, Office of the Surgeon General, Public Health Service. His paper is an interim report on a long-term study.

Hospital Utensils

In February 1952, during the emergency in Korea, a meeting of an industry advisory committee of utensil manufacturers was held at the request of the National Production Authority (now the Business and Defense Services Administration). The agenda included, among other things, industry requests for assurance of a continued supply of chrome nickel stainless steel for the manufacture of hospital utensils and a discussion of the necessity for chrome nickel stainless steel in this class of items. If type 430 stainless steel is used exclusively, an estimated 10,000 pounds of nickel could be diverted annually to other purposes. Since no accurate or detailed information was known to be available about the durability of non-nickel stainless steel utensils, it was agreed to study selected utensils in use. The control authorities agreed that while the study proceeded manufacturers would continue to receive allocations of nickel-bearing stainless steel. Industry representatives offered to provide nickel-free utensils for the study. The Public Health Service agreed to oversee and arrange for tests in a hospital of six of each of the following utensils: bedpans, urinals, kickbuckets, and catheter trays with covers. Three of each were type 430 and three of each were type 302.

Through the cooperation of the American Hospital Association, arrangements were made to place the utensils in regular service at the Wesley Memorial Hospital in Chicago in September 1952. Basic instructions called for all test items to be kept in continual routine service and to be treated in the usual manner. Only supervisory personnel were aware of the test.

After 1 year of use, the utensils were forwarded to the office of Civilian Health Re-

Hospital Utensils

FIRST YEAR INSPECTION RESULTS

Item	Type 302 (8 percent nickel)	Type 430 (no nickel)
Bedpans	Few scattered pits on inside bottom; slight discoloration; some corrosion and rust at weld line.	Many small scattered pits on inside; rust and pits at weld line; some discoloration.
Kickbuckets	Some discoloration; few light rust spots and pits on inside.	Moderate discoloration; rust spots and few deep pits on inside.
Urinals	Inside coated with deposit; spot welds on handle show rust; some rust and pits on inside walls and bottom inside; some staining.	Considerable rust inside at welds (handle); moderate staining or rust in neck and some pitting inside bottom. One had fabrication tear at pour lip.
Instrument trays with covers (8″ x 2½″ x 1½″).	Except for slight dulling and baked-on deposits of previous contents, no defects.	Same as type 302 plus slight rust on one cover inside.

CONCLUSIONS: It was the consensus of those examining the utensils that there was a definite need for improved cleaning techniques. It was their opinion that proper cleaning should improve corrosion resistance of both types of stainless steel. Type 302 showed superiority in corrosion resistance. However, the usefulness of type 430 utensils was not diminished because of the defects noted and there was no conclusive indication of early failure. One year of test proved insufficient to determine durability of type 430 stainless steel hospital utensils.

SECOND YEAR INSPECTION RESULTS

Bedpans	Few light rust stains on outside; some rust along weld on inside, also occasional rust spots on inside bottom and rolled bead (hem).	Few rust spots and pits on outside and along weld; numerous rust spots mainly on inside weld seam and bead. Scattered tiny pits on bottom.
Kickbuckets	Occasional discolored area on outside; few scattered rust stains, discolored areas, and etched spots on inside. One had several dark etched areas. Rust at a bail ear was observed on one.	Mottled and discolored on outside. One showed rust staining on outside bottom and mottled rust stains on a bail ear. One bucket, showing evidence of improper use, had four severe etched areas on curve of inside bottom; one area was perforated to the outside, making the bucket useless. Another bucket showed heavy etching on inside, with extensive discoloration to bottom third of bucket. Many etched and red rust spots and tiny pits were noted in discolored area.
Urinals	Occasional red rust stains at edge of rolled rim; superficial corrosion at handle welds; inside heavily discolored and coated with deposit; scattered rust spots on inside.	Rust on rolled rim; occasional rust spot and pits on outside. One had fabrication tear on pour lip. Heavy deposit on inside with discoloration pitting and rust spots on inside weld area.
Instrument trays with covers (8″ x 2½″ x 1½″).	Slight dulling of sheen on inside	Occasional tiny pit and rust spot on inside.

CONCLUSIONS: After examination by essentially the same group who inspected the items 1 year earlier, it was felt that only moderate changes in type 302 chrome-nickel stainless steel were noted. Aside from the perforated kickbucket, serviceability of utensils was not significantly diminished by the use of type 430 non-nickel stainless steel. It was again evident that proper or complete cleaning was not accomplished and that this point must be emphasized to obtain the best service from all stainless steel utensils in hospitals. It was the opinion of the inspecting group that type 302 stainless steel showed superiority over the type 430, but additional testing should be pursued before final judgment.

quirements. With the exception of one type 430 urinal, all utensils were accounted for. These were inspected by representatives of interested Government agencies, including stainless steel and corrosion experts from the National Bureau of Standards, Armed Services Medical Procurement Agency, and the Business and Defense Services Administration of the Department of Commerce.

After a review of the findings, it was decided at a subsequent industry advisory committee meeting that the utensils should be tested further and that the testing institution should, preferably, be near the seashore so the effects of salt air on the utensils could be studied. The Department of Defense arranged for a controlled test at the Key West Naval Hospital in Florida.

The second test was completed and the utensils were returned to Washington for inspection by the same agencies. (One urinal and one kickbucket, both type 430, were misplaced and not returned from Key West). Results of the two tests appear on facing page.

Operating Room Furniture

In addition to the control on the use of nickel in utensils, the National Production Administration, early in 1951, had issued a restrictive order (NPA Order M–80) which prohibited the use of nickel steel in the manufacture of operating room furniture.

By a fortunate coincidence, purchase orders for equipment for the Clinical Center at the Public Health Service National Institutes of Health, then under construction, were being compiled. With this opportunity to test operating room furniture made from type 430 stainless steel, specifications were modified on a selected list of items. The following type 430 stainless steel items containing no nickel were among those obtained from the manufacturer:

1 linen hamper.
3 stands, irrigator (not placed in service).
1 stand, solution, single, Baker model.
1 stand, solution, double, Snyder model.
1 table, major operating pedestal, large.
2 stands, instrument, Mayo.
1 stool, anesthetist's, Bryson model.
2 stools, foot, 10″ x 14″ x 8″.
2 stools, revolving.
1 stool, foot, 12″ x 30″ x 4″.
2 tables, instrument, curved, 12″ x 60″ x 33″ (not placed in service).
1 table, utility, 16″ x 20″ x 33″.
1 table, utility, 16″ x 20″ x 30″ (not placed in service).

The operating room furniture serving as controls has not been listed above because adequate control was afforded by the normal course of simultaneous purchases of type 302 duplicate chrome nickel items for the other Clinical Center operating rooms. The operating room furniture was placed in general service in July 1953 at the Clinical Center. After 1 year of use it was inspected by the Sanitary Engineering Branch of the Division of Research Services, National Institutes of Health, and was then returned to routine service for a second year. The operating room furniture was inspected at the end of the second year by the National Bureau of Standards as well as the Sanitary Engineering Branch.

Detailed reports on individual items of operating room furniture for the first year were not received. However, all furniture pieces fabricated from type 430 stainless steel compared favorably with the type 302 items, except for surface scratches. Both types of furniture were kept in continual and equal service, and all surfaces were kept scrupulously clean. No significant signs of rust, pitting, or staining were reported at the end of 1 year. Detailed results of the second year tests follow.

Continuation of Tests

Upon completion of the second year of testing and inspection, the interested agencies agreed that periodical examination of the equipment should be continued indefinitely. Preferably, this additional testing would continue until failure of each item.

In addition to the continuation of the tests at the Clinical Center, the Bureau of Medical Services of the Public Health Service provided another site for the utensil testing, the Public Health Service Hospital in Baltimore, Md. By the use of a "quarterly inventory-annual report" system, followup information is expected to be current. Due to the long period which may be required, each utensil was engraved "on

Operating Room Furniture

SECOND YEAR INSPECTION RESULTS

Item	Type 302 (8 percent nickel)	Type 430 (no nickel)
Utility tables	A few scratches on surfaces	Top scratched and discolored. Discoloration but no rust at welds.
Stools, revolving	No indications of rust	Slight rust where ring welded to legs on one.
Operating tables	do	No indications of rust.
Solution basin stands, single	do	Some discoloration at welds but no rust stains.
Solution basin stands, double.	do	No indications of rust.
Stands, Mayo type	do	Do.
Stools, anesthetist's	do	Do.
Stools, foot	Slight rust stains at junction of lines with seat and at welds on legs.	Definite rust at junction of lines with seat and at welds on legs.
Linen hamper racks	Few scratches; clean welds	No indications of rust; clean welds.

CONCLUSIONS: The summary judgment reached by those examining the items was that type 302 articles are in slightly better condition than type 430. The difference, however, is not significant at this time. The evidence of excellent cleaning was apparent for all items inspected. An interim judgment would suggest that hospital operating room furniture fabricated from type 430 chrome stainless steel would be sufficiently durable to serve as a satisfactory alternate for type 302 chrome nickel stainless steel.

test" and assigned an arbitrary number for positive long-term identification. Information as to failure or significant signs of early failure will be forwarded to mobilization planning agencies at appropriate intervals.

The marked evidence that routine cleaning methods of the utensils was inadequate obviously indicates that more information on the care of stainless steel should be disseminated. In this regard, through the efforts of the National Research Council and of the American Iron and Steel Institute, the preparation of a comprehensive booklet covering the care of stainless steel is being considered. Hospital administrators and others concerned with extending the life and maintaining the appearance of stainless steel utensils and fixtures will find such a booklet very practical.

Summary

After 2 years of service testing of hospital utensils and operating room furniture, there is evidence that nickel-bearing stainless steel, with its corrosion resistance characteristics, is superior to non-nickel stainless steel. The margin of superiority noted, however, was not conspicuous in the furniture. With the exception of one kickbucket, deterioration was generally not severe or of a nature to destroy the usefulness of the article. Only minor instances of deterioration were observed in the non-nickel stainless steel operating room furniture.

Professional Nurse Traineeship Program

In a new program enacted by Congress on July 23, 1956, the Public Health Service is providing traineeships to assist graduate nurses in furthering their professional education.

For the academic year 1956–57, 553 traineeships totaling nearly $2 million have been awarded under the new law (P. L. 911, Title II) to 56 schools of nursing and schools of public health throughout the United States and in Puerto Rico.

Mary O. Jenney, a Public Health Service officer since 1942, is in charge of the new program. She had been with the Division of Hospitals since 1947.