Mailing of Infectious Specimens for Diagnostic Purposes

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FOR the past several years the U.S. Post Office Department, the Universal Postal Union, and the World Health Organization, as well as the Public Health Service, State health department laboratories, and other domestic health agencies, have been concerned with improving the procedures for rapid and safe transmission to diagnostic and research laboratories of material containing or suspected of containing pathogenic organisms.

Such organisms form only a small part of the diagnostic shipments. Most of the material received by laboratories is not even suspected of containing infectious agents. For example, in 1958 only 4 to 9 percent of the total specimens received by six State laboratories, for which information was at hand, were sent to be tested for the presence of a live infectious agent.

The Communicable Disease Center of the Public Health Service, the major Federal recipient and transmitter of infectious diagnostic specimens, has defined such specimens as follows:

1. All specimens of human or animal excreta, secreta, tissue or tissue fluids, or hair, which contain or are suspected of containing a live causative agent of a human disease or an animal disease transmissible to man, and which are shipped or mailed to a diagnostic or research laboratory for isolation and identification of the etiological agent.
2. Pure cultures or concentrated isolates or vectors of etiological agents shipped from the isolating or collecting laboratory to a specialty laboratory for identification and typing, or further research, or both.
3. Pure cultures of known etiological agents which are used as reference cultures or as antigens in diagnostic laboratory procedures.

We have been unable to learn of any instance in which a person employed in transportation was infected with disease through handling of diagnostic specimens or other mail with which the specimens might have come in contact. It has been recognized that the hazards of shipping these specimens are relatively low and that their rapid and unobstructed movement is of vital importance in communicable disease control. There are no regulations in effect or contemplated which would hamper the free movement of this material. Yet this comparative freedom from regulation should not serve to encourage the neglect of adequate precaution in the shipment of diagnostic specimens.

Because the Laboratory Branch, Communicable Disease Center, annually processes and mails out large numbers of infectious specimens, a series of experiments were conducted to develop a shipping procedure which would be safe, simple, and inexpensive and which would comply with the principles of the Public Health Service regulations governing the shipment of etiological agents (*1*) and also with the conditions set by the Convention of the Universal Postal Union (see excerpt p. 983). As a result of these experiments, a safe and practical packaging procedure has been adopted

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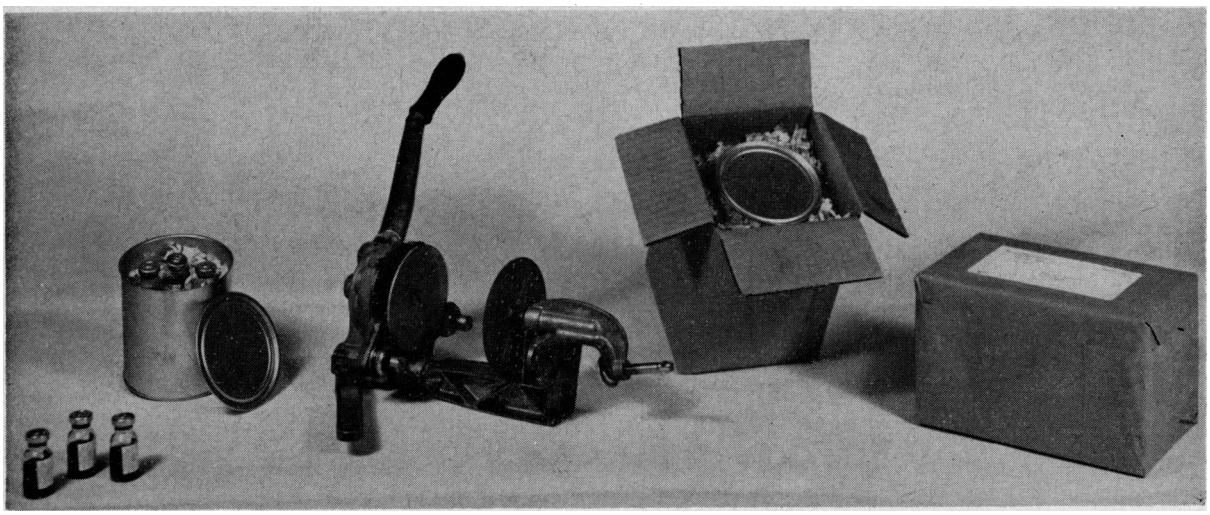

Figure 1. Steps in assembling package

for all shipments of infectious diagnostic material from the Laboratory Branch. This procedure has been tested by actual use for more than a year and has already been introduced to State laboratory directors.

In brief, the packaging procedure is as follows. The specimen is enclosed in a bottle or tube of thick glass which is sealed with a rubber or paraffin-treated cork. Enclosure by fusion, of course, is also acceptable. Screwcaps are not recommended because leakage frequently occurs, particularly when outside pressure decreases during air transportation. The cork is secured with a metal collar or with a good grade of adhesive tape. The glass container is then placed in an airtight and watertight tin can with vermiculite, sawdust, or other suitable material for insulation. The can is packed in a cardboard container with shock-resisting insulating material and wrapped for shipping (fig. 1).

Glass bottles are preferred to test tubes because of their greater shock resistance and are used by the Laboratory Branch whenever practical. However, heavy-walled test tubes are entirely acceptable provided there is sufficient space in the can for shock-absorbing material to be packed all around the tube. If several tubes are packed in the same can, it is important that they be wrapped individually in soft paper or cloth to provide adequate insulation between the tubes.

The bottles presently being used at the Laboratory Branch are regular hard glass serum bottles in sizes from 2 ml. up. The bottles are sealed with a rubber stopper secured in place with an aluminum collar. Prices of the bottles, depending on size, quantity, and type of stopper, begin at 2 cents per setup.

The tin cans in use are regular No. 3 household cans sealed by roll crimping the lid with a home canning device. The cans are priced at approximately 12 cents each when purchased in quantities of 100. The price of a satisfactory canning device is less than $15. Pressure-sealed paint cans in quantities of 100 are priced approximately as follows: pint, 11 cents each; quart, 13 cents; half gallon, 23 cents; gallon, 29 cents. For an occasional shipper, such as a research institute or hospital, they offer the advantage of not requiring a crimping device. The larger sizes are practical for occasional large-quantity shipments and may be used as the outer containers required by the international postal regulations.

In our experiments, the No. 3 crimped-sealed cans proved to be remarkably resistant to various outside forces. They withstood slow vertical pressure of 3,000 pounds per can very well. "Rapid" pressure of 3,000 pounds slightly indented the cans but did not break the bottles inside. They resisted horizontal pressures up to 800 pounds per can without losing their shape. When the pressure was increased to 1,200 pounds, the cans were compressed to a boxlike shape, still without break-

ing the bottles inside (fig. 2). Sharp shocks produced by dropping unwrapped cans onto concrete several times from a height of 20 feet caused only slight denting of edges (fig. 3).

Since a considerable percentage of diagnostic specimens are sent by airmail, a number of airdrops were also performed. This was made possible through the assistance of the Naval Air Station, Marietta, Ga. (then of Chamblee, Ga.). Surprisingly little damage was caused by dropping packages and unwrapped cans from an airplane flying at an altitude of 1,000 to 1,500 feet (fig. 4).

The only breakage of the contents of the cans in the airdrops occurred in a can which contained 16 regular 15- by 150-mm. test tubes, the only insulating material being a thin layer of paper between the tubes. In this can, 1 tube of the 16 broke; the others remained intact. All other glass containers, including several milk-dilution bottles which were packaged with a sufficient amount of shock absorber, were unbroken and unopened. Seventeen packages were dropped in this experiment.

Rapid decompression experiments were conducted through the cooperation of the U.S. Naval School of Aviation Medicine, Pensacola, Fla. In these tests, explosive decompression to 1.69 pounds per square inch in 0.1 second, corresponding to the maximum stress likely to be encountered if the cabin of an airplane should suddenly decompress at an altitude of 50,000 feet, caused only slight bulging on the ends of the cans. The leakage from the bottles in the cans was checked by using varying amounts of colored alcohol in the bottles and white absorbent cotton around the neck of the bottles (fig. 5). No leakage occurred.

Actively metabolizing saccharomyces cultures did not cause any observable bulging of the sealed cans during a sustained incubation period at 37° C.

Our experience with the paint cans has been essentially the same as with No. 3 household cans. None of the paint cans came open despite rough handling (fig. 4). However, our experiments with paint cans have been limited to products of one manufacturer. Therefore, we are recommending that until additional experience is gained, the lid of larger size paint cans be spot soldered before wrapping. It can be

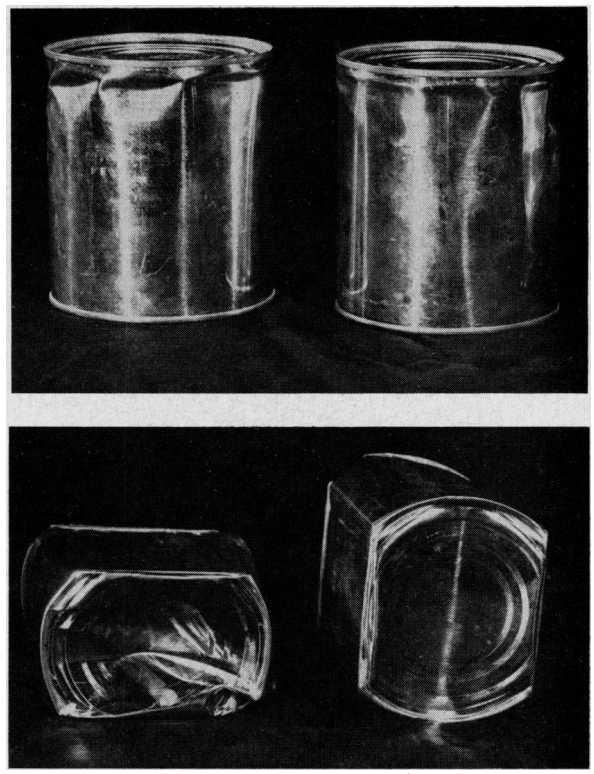

Figure 2. *Above*, cans subjected to 3,000 pounds vertical pressure; *below*, cans subjected to 1,200 pounds horizontal pressure

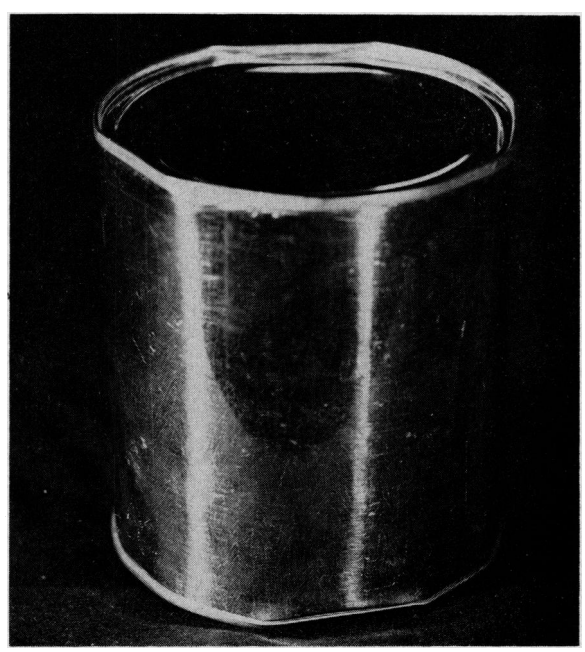

Figure 3. Unwrapped can dropped 10 times onto concrete from height of 20 feet

done easily by using low-melting wire solder. Three or four spots are believed to be sufficient.

The staff of the Communicable Disease Center, on the basis of the tests cited, is convinced of the safety in shipment of infectious or potentially infectious diagnostic specimens packaged in the manner described and commends these procedures to laboratories and others concerned.

The Laboratory Branch was informed recently that the Post Office Department, with more than 36,000 post offices, cannot possibly insure that packaging requirements will be complied with. Therefore, the Department does not rely on regulations and their enforcement for compliance but on a criminal statute which places the liability on shippers for proper packaging.

The criminal statute concerned (18 U.S.C. 1716) is of material interest to all shippers of diagnostic specimens whether potentially pathogenic or not. In fact, most intransit damage to laboratory specimens involves blood specimens for serology and urine specimens for chemical testing rather than testing for pathogenic organisms. If spillage occurs so as to injure or damage mail, equipment, or personnel, the shipper may face prosecution even though there is no question of hazard from an infectious agent. The value of careful packaging with a sufficient amount of absorbing material around the glass to soak up any leaking fluid, therefore, extends well beyond the major concern of this report, the prevention of infection.

Regarding the international transport by mail of perishable biological material which may contain living pathogenic micro-organisms and viruses, the most recent Convention of the Universal Postal Union contains two main points:

- Letter mail containing perishable biological materials shall be packed according to the precise description given and identified by a label adopted for the purpose. (The label is illustrated on the frontispiece.)
- Such letters shall be exchanged only between "officially recognized laboratories."

More complete information on the provisions of this convention and packaging requirements

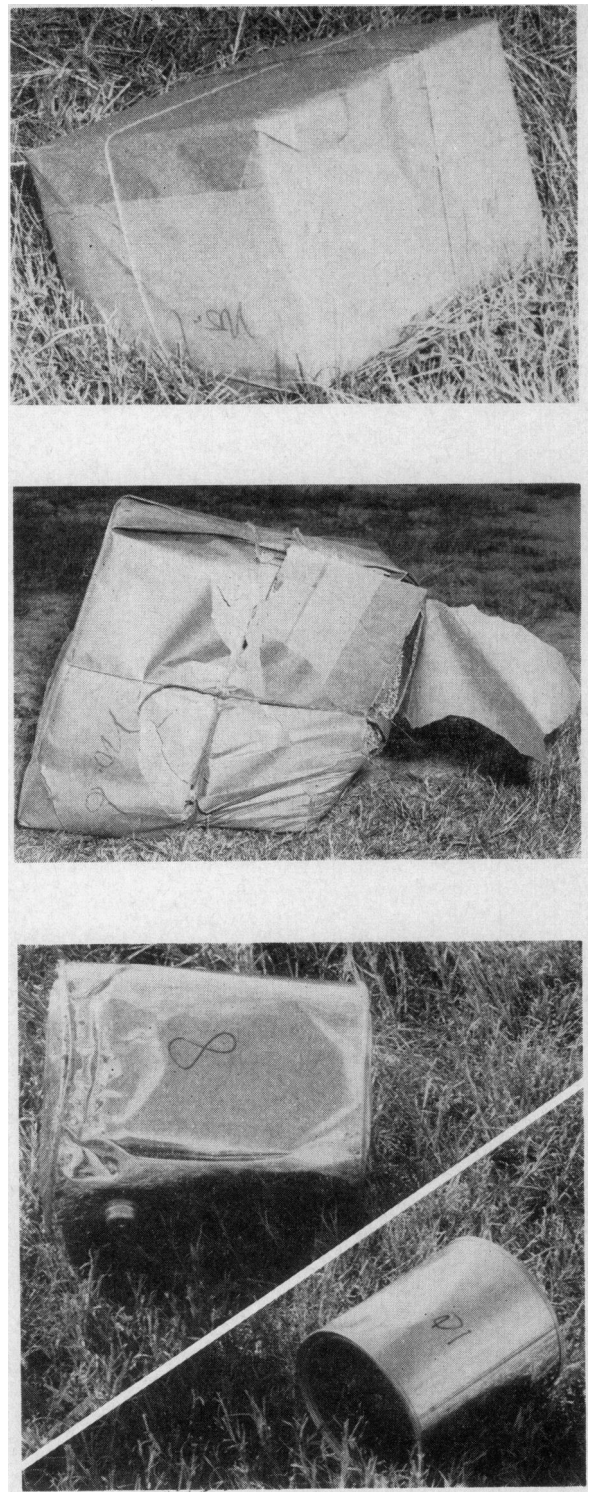

Figure 4. Packages and cans dropped on hard sun-baked ground from a plane at 1,000 to 1,500 feet altitude. *Above*, package with least damage; *center*, package with most damage; *below*, unwrapped cans

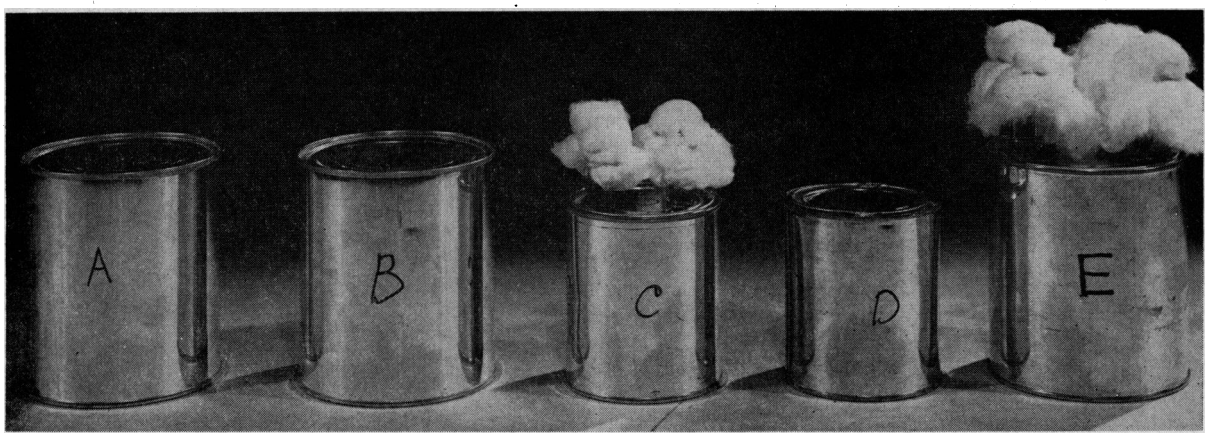

Figure 5. Cans subjected to explosive decompression to 1.69 pounds per square inch in 0.1 second. A and B are household cans, C, D, and E, paint cans. Bottles on top of C and E were removed from cans after the experiments. Colored alcohol was put inside the bottles and cotton around the necks to check for leakage

for international mailing are given in the excerpt from the Postal Manual below.

In order to avoid misunderstanding, it should be pointed out that the requirement of the Convention of the Universal Postal Union to use violet-colored labels on packages carried in international letter mail is in addition to and not in lieu of any Federal quarantine regulations (*2*,*3*) which require an import permit for etiological agents and vectors. For human pathogens, request for an import permit should be made in advance to the Surgeon General, Public Health Service, Attention, Division of Foreign Quarantine, Washington 25, D.C., and for animal pathogens, to the Inspection and Quarantine Division, Agricultural Research Service, Department of Agriculture, Washington 25, D.C. Shipments arriving without permits are subject to delay which may destroy the viability of the specimens. An advance permit from the Department of Agriculture is also required when shipping imported animal pathogens and vectors between laboratories in the United States.

EXCERPT FROM POSTAL MANUAL

221.325 *Perishable Biological Materials*

a. Mailing Restriction

Perishable biological materials, including those of pathogenic nature, when sent in the postal union mail may be sent only as letter packages packed as prescribed in 221.325c, and may be sent only to the countries that have agreed to accept them. The packages must bear distinctive violet labels by which they can readily be recognized and receive careful handling and prompt delivery. The countries that have agreed to accept letter packages containing perishable biological materials are:

Aden
Argentina
Australia
Austria
Barbados
Belgian Congo
Belgium
Bermuda
Cayman Islands
Cyprus
Czechoslovakia
Denmark
Falkland Islands
Fiji Islands
Germany (Eastern)
Ghana
Gibraltar
Gilbert and Ellice Islands
Great Britain and Northern Ireland
Hong Kong
Hungary
Iceland
India
Israel (infectious substances not permitted)
Jamaica
Japan
Kenya and Uganda
Lebanon
Malaya
Malta
Mauritius
Netherlands Antilles
New Zealand
Nigeria
North Borneo
Norway
Persian Gulf ports
Philippines
Poland
Portugal
Rhodesia and Nyasaland
Saint Helena
Salvador (El)
Sarawak
Sierra Leone
Somaliland Protectorate
Spain
Sudan
Sweden
Switzerland
Tanganyika
Trinidad
Turkey
Turks Islands
Union of South Africa, except Basutoland and Swaziland (added February 25, 1960)
Uruguay
Zanzibar

b. Qualification of Mailers

(1) Only officially recognized laboratories may send or receive letter packages containing perishable

biological materials. Laboratories of the following categories are so designated:

Laboratories of local, State, and Federal Government agencies.

Laboratories of federally licensed manufacturers of biological substances derived from bacteria and viruses.

Laboratories affiliated with or operated by hospitals, universities, research facilities, and other teaching institutions.

Private laboratories licensed, certified, recognized, or approved by a public authority.

(2) A laboratory desiring to mail letter packages containing materials of this kind shall make written application on its letterhead stationery to the International Service Division, Bureau of Transportation, Post Office Department, Washington 25, D.C., explaining its qualifications and those of the prospective addressee to send and receive such materials, and stating how many packages are to be mailed. On approval, the mailer will receive a sufficient number of the violet labels for the contemplated shipments.

c. Packaging

(1) Perishable biological material not of a pathogenic nature must be packed in a nonporous container surrounded by sufficient absorbent material to take up all the liquid and must be placed in an outer protective container where it should fit tightly to avoid any shifting.

(2) Perishable biological material of a pathogenic nature must be packed in a tightly closed bottle or tube of heavy glass wrapped in thick, absorbent material rolled several times around the bottle or tube and tied at the ends, sufficient in quantity to absorb all the liquid; the wrapped container must be placed in a strong, well-closed metal box so constructed as to prevent any contamination outside of it. This metal box must be wrapped in cushioning material and placed in an outer protective box where it should fit tightly so as to avoid shifting. The outer container must consist of a hollow block of strong wood, metal, or other equally strong material with a tight lid so fitted that it cannot open during transportation.

(3) In addition to the requirements in (1) and (2), packages must comply with the regulations governing the transmission of such materials in the domestic mail.

(4) The mailer must place on each package one of the violet labels mentioned in a and b(2).

REFERENCES

(*1*) U.S. Public Health Service: Regulations. Shipment of certain things. 42 CFR 72.25 (1960).

(*2*) U.S. Public Health Service: Regulations. Importation of certain things. 42 CFR 71.156 (1960).

(*3*) U.S. Department of Agriculture, Bureau of Animal Industry: Regulations. Organisms and vectors. 9 CFR 122.1 (1959).

Anti-Pollution Study in Great Lakes Basin Waterway

A 6-year anti-pollution study of the U.S. portion of the Great Lakes Basin-Illinois Waterway was launched by the Public Health Service in September 1960.

The study, which was authorized by the 86th Congress with $500,000 for the first year, is designed to aid the development of a comprehensive plan to control and prevent pollution in the area.

Under the jurisdiction of the Service's Division of Water Supply and Pollution Control, immediate efforts are directed to:

- An inventory of all points of inflow into the Chicago River, Sanitary and Ship Canal, the Calumet-Sag Canal, and their tributaries.
- Measurement and analysis of municipal and industrial wastes being discharged at such points of inflow.
- Effect of such discharges on water quality of the Illinois Waterway under present rate of flow.
- Methods of improving the water quality of the Illinois Waterway.
- Determination of the water quality of the Illinois Waterway under present and various decreased rates of flow.

Project headquarters are in Chicago, under the direction of William Q. Kehr, Public Health Service engineer. The overall project, with a staff of 40 scientists and technicians, is coordinated by H. W. Poston, water program director of the Service's regional office in Chicago.

A special master of the Supreme Court has been conducting hearings in cases which concern the use of Lake Michigan water and to which the States of Wisconsin, Michigan, Illinois, Minnesota, New York, Pennsylvania, and Ohio and the United States are parties. The study has been planned so that data gathered in the first phases will assist the Court in making its decisions.