

Development of Automation Machines in Fluorescent Light Tubes Recycling Factory, JFE Kankyo[†]

1. Introduction

JFE Kankyo began recycling of fluorescent light tubes in November 1994. Although limited to trace amounts, the hazardous metal mercury is used in fluorescent light tubes. In spite of the presence of this mercury, it is estimated that most discarded fluorescent light tubes in Japan are disposed of by landfills, as only somewhat over 30% are recycled.

We have been endeavoring to contribute to a sound material-cycle society (recycling-based society) and reduce environmental loads by performing recycling treatment of discarded fluorescent light tubes. We treat approximately 5 000 tons of fluorescent tubes per year including those discarded by group companies. Converted to 40 W straight tubes, this is equivalent to 20 million tubes per year. The flow of the fluorescent light tubes recycling process is shown in Fig. 1. We perform recycling treatment of diverse types of fluorescent light tubes, including straight tube-type fluorescent

lights. When fluorescent light tubes are charged to the recycling equipment, first, the two ends of the tube are cut off. Next, the phosphor adhering to the tube interior is blown out by compressed air and recovered. The glass tube part is pulverized and washed and becomes final products. The mercury in the recovered fluorescent powder is separated and recovered by distiller and is also recycled. Although many fluorescent tubes can be handled by this type of automatic treatment, the tubes delivered to the company's recycling factory also include some that had required pretreatment before charging to the recycling equipment. These were (1) fluorescent tubes which are delivered without removal from the paper packing case, (2) shatterproof-type tubes, in which the surface of the glass tube is covered with a film, and (3) tubes with aluminum electric conduction tape pasted on the surface. This article presents an outline of equipment that was developed and introduced for automation of pretreatment processes for these three types of fluorescent tubes.

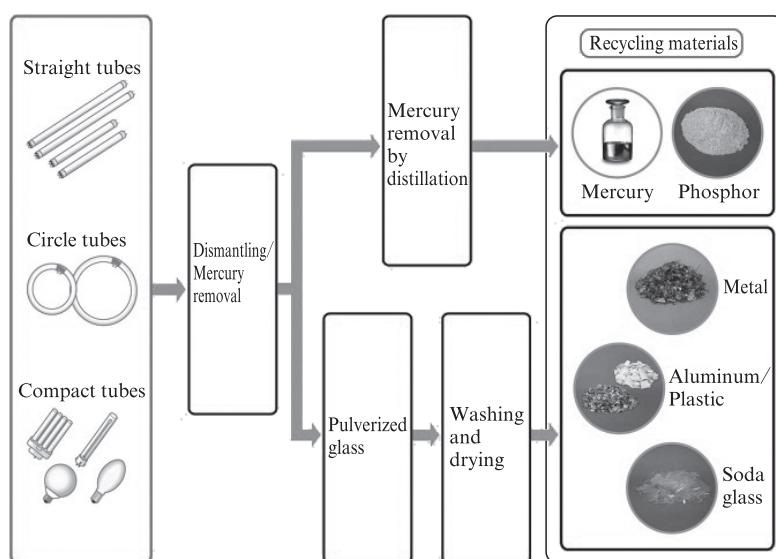


Fig. 1 Fluorescent light tubes recycling process

[†] Originally published in *JFE GIHO* No. 32 (Aug. 2013), p. 115–116

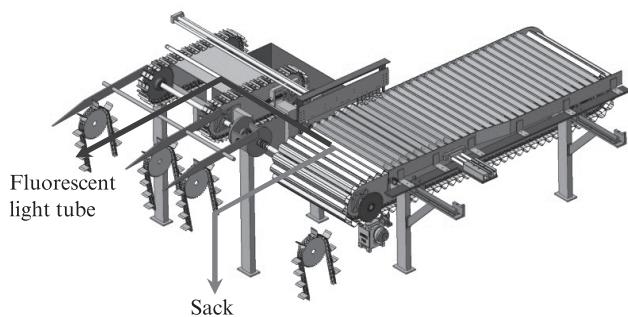


Fig. 2 Packing stripper

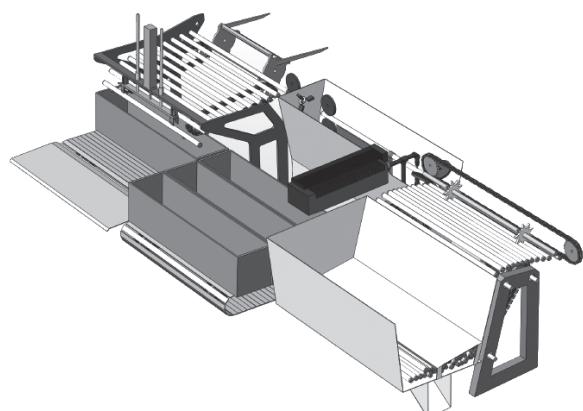


Fig. 3 Plastic film removal machine

2. Automation Machines

2.1 Packing Stripper

About 20% of the fluorescent light tubes delivered to the company, or approximately 3.2 million tubes each year, are still contained in paper packing cases. Before introduction of the automatic device, workers had separated and recovered the fluorescent tubes and paper packing by manual work, which was performed one piece at a time. In 2007, we developed and introduced a packing stripper (Fig. 2) which automatically removes the fluorescent tubes contained in the paper packing. This machine can handle 40 W tubes and 32 W Hf tubes (Length: 1 200 mm) and has a processing capacity of 1 500 tubes per hour. The packing stripper is installed upstream of the fluorescent light tubes recycling equipment, enabling continuous automatic processing from pretreatment through recycling processes.

2.2 Plastic Film Removal Machine

Shatterproof fluorescent light tubes, which have a plastic film on the surface of the glass tube, are widely used at train station platforms and in trains. The company receives approximately 300 000 of these tubes each year. Before introduction of the automatic plastic film removal machine, operators had removed the film by cutting it with a cutter knife and then peeling it from the tube. A laser machine (Fig. 3) was developed and introduced in 2010, resulting in improved work efficiency and greatly improved productivity. This machine is used with 40 W type straight tubes and has a shatter-proof film tube treatment capacity of 1 000 tubes per hour.

2.3 Conduction Tape Removal Machine

Conduction tape is one of the starting auxiliaries used with rapid-starting type fluorescent lamps. In this type of fluorescent tube, conduction tape is pasted on the outside surface of the glass tube of the fluorescent light. Before introducing mechanical treatment, pretreatment has been performed by manually peeling this tape with a

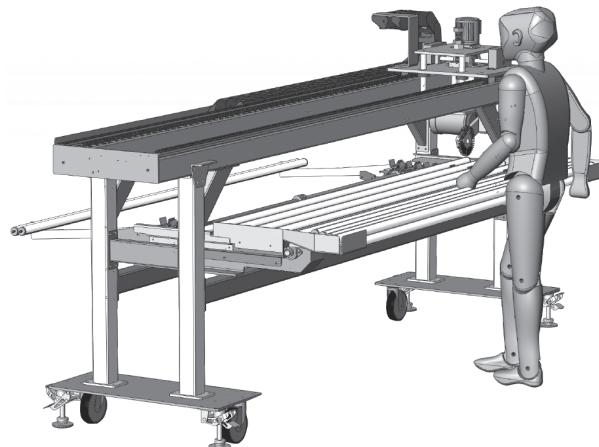


Fig. 4 Electric conduction tape removal machine

special cutter. The aluminum electric conduction tape removal machine (Fig. 4), which uses a brush mechanism, was developed and put into operation in 2011. It is used with 110 W straight fluorescent tubes and has a capacity of 360 tubes per hour.

3. Conclusion

New three automation devices for fluorescent light tubes recycling were introduced: (1) paper packing stripper, (2) shatterproof plastic film removal machine, and (3) conduction tape removal machine. All three machines were developed originally by JFE Kankyo own and are the "Only One" of their kind in the world. As a result of introduction of this equipment, much labor-intensive pretreatment work was successfully automated.

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