New Technology

Development of Feeder “TRINITTE” for Picking Robots

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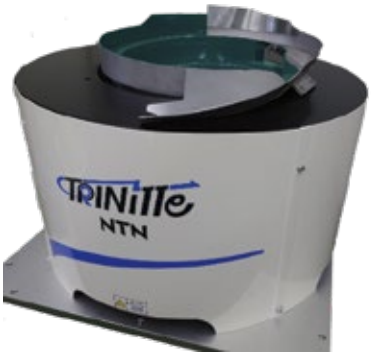

NTN has developed a new parts feeder (TRINITTE) that combines a conventional parts feeder and a rotating disk and is developing it into a field that transcends the field of the conventional parts feeder.
In this article, I will explain the outline, features and specifications of TRINITTE.

1. Introduction

There has been a rapid expansion in automation and manpower reduction globally using industrial robots with the aim of increasing productivity at the manufacturing site. This situation has occurred because of the diversification of consumer needs, and the shift from mass production to “high-mix low-volume production”. For parts feeders, there is a need to reduce production changeover time due to the support for a wide variety of workpieces, and a need to decrease brief stoppages in production due to workpiece jamming (improve availability factor).

For the conventional parts feeder and picking robot combination, the workpieces are selected and sorted in a bowl feeder were stored in straight feeders, a delivery mechanism used to deliver each workpiece, and then the workpieces were picked up by a picking robot. This setup had issues, which were that only certain workpieces could be handled, many working components were required, and workpieces became jammed when sorting or storing them inside feeders.

However, parts supply devices are now being sold for robots on the premise that sensing technology is used in combination with picking robots. Parts supply devices for robots use 3-axis vibration technology to change the posture of workpieces in the picking area and to separate workpieces if they are too close to each other, and a camera is used to detect the workpiece position so that the picking robot can pick up the workpiece. The issue with this setup is that if a workpiece with a pickable posture is not present in the picking area, the machine operates to change the posture, so the robot stops during this time.

NTN has developed TRINITTE to solve these issues.

2. Overview

Fig. 1 shows the system configuration. TRINITTE comprises a motor-driven rotating disk arranged on the outer circumference of a conventional bowl feeder, and an encoder attached to the rotating disk. A camera and picking robot are connected to the system so that the picking robot can import pulse signals output from TRINITTE and image processing signals obtained from the camera.

The following explains the full sequence of the picking system that combines TRINITTE with a robot.

Workpieces deposited in the bowl are sorted in a single-row single-layer arrangement by the bowl feeder, then supplied onto the rotating disk. The workpieces supplied onto the rotating disk are picked up without stopping the rotating disk using a robot arc conveyor tracking function[*1], then supplied to the next process. Any workpieces that could not be picked up are also collected inside the bowl feeder via a workpiece collection opening located on the rotating disk. These recovered workpieces are once again supplied via the bowl feeder onto the rotating disk.

*1 Vision sensors are used to detect the position of a workpiece at any position on the rotating disk. This information and information from the encoder is used by the robot so that it can follow the rotating disk and pick up the workpiece from the disk.

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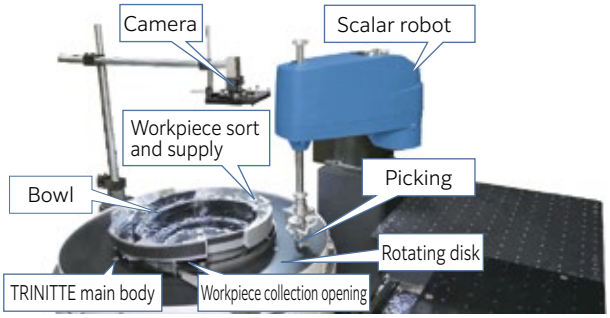


Fig. 1 System configuration

3. Features

TRINITTE has the following features.

(1) Saves space

TRINITTE is different to conventional parts feeders and uses a rotating disk to supply workpieces, so it does not require a straight feeder, a chute or a workpiece separating mechanism. Therefore, as shown in **Fig. 2**, the number of working components can be reduced to cut the footprint by approximately 30 %.

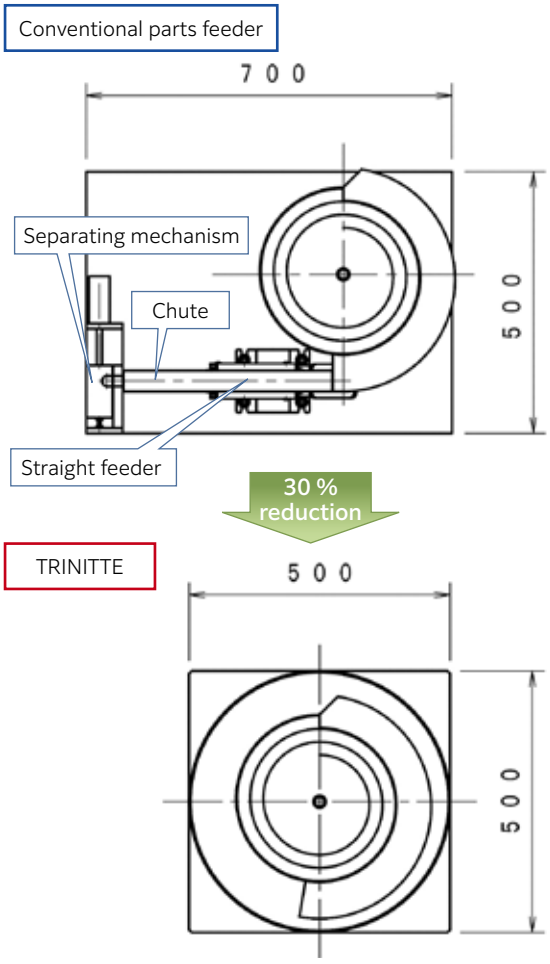
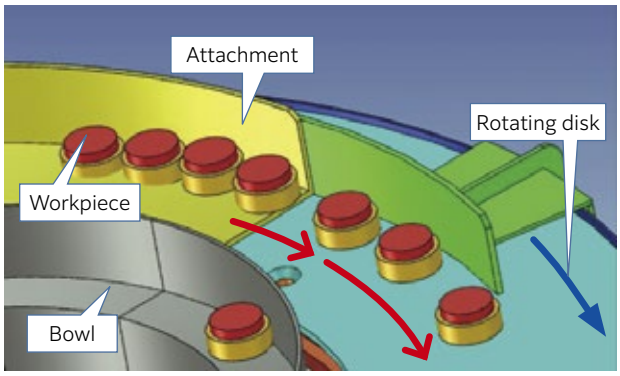


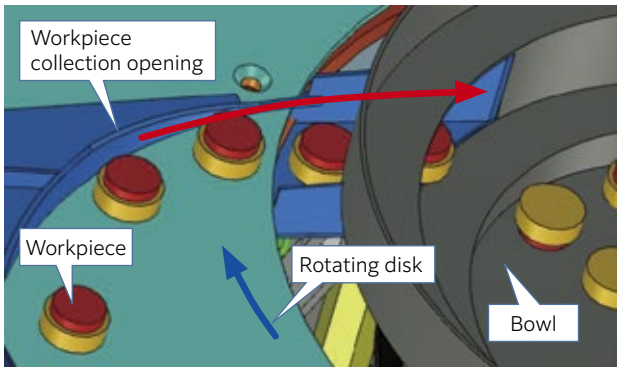
Fig.2 Comparison of size between conventional parts feeder and TRINITTE

In addition to supplying workpieces to the robot using the rotating disk, this product has a simple and compact structure that can also separate workpieces and recover unpicked workpieces, enabling it to perform three tasks in a single unit.

Increasing the rotational speed of the rotating disk more than the supply speed of the bowl feeder enables workpieces that are ejected in a joined manner to be separated, making it easier for the robot to pick up. Workpieces that could not be picked up by the robot are also collected inside the bowl so that they can be supplied once again onto the rotating disk **(Fig. 3)**.



(a) Workpiece separation



(b) Workpiece recovery

Fig. 3 Workpiece separation and recovery

(2) Reduces brief stoppages

Conventional parts feeders use an attachment with a complex structure installed on the bowl feeder to arrange the posture of workpieces in the bowl feeder. This complex structure makes it easy for workpieces to become jammed when they are caught on the attachment, etc.

TRINITTE links the vision system and picking robot together so that the attachment installed on the bowl feeder has only a simple structure to perform tasks such as aligning the orientation of workpieces. Since the attachment can be simplified, continuous supply of stable parts is achieved.

(3) Reduces robot wait time

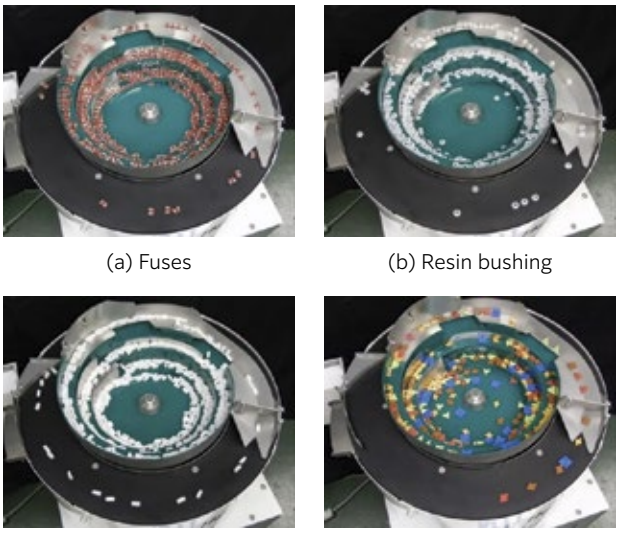
TRINITTE ensures that workpieces are aligned so that their orientation matches in a single-row

single-layer arrangement and enables a continuous supply of workpieces at the picking area of the picking robot. Therefore, workpieces on the rotating disk can always be picked up and the robot can continue picking up workpieces. Furthermore, as mentioned previously, the use of an arc conveyor tracking function on the picking robot enables constant operation without stopping the rotating disk, so this increases the equipment availability factor.

(4) Improves versatility

TRINITTE can simplify the attachment installed on the bowl feeder, which makes it possible to support a wide variety of workpieces **(Fig. 4)** by making simple adjustments only, without changing the bowl feeder. This can reduce the time required for production changeover.

Additionally, workpieces that could not be stored and could not be supported with conventional parts feeders, or irregular-shaped workpieces can now be supported, demonstrating that this is a device with high versatility.



(a) Fuses (b) Resin bushing

(c) Connectors (d) Resin blocks

Fig. 4 A wide variety of workpieces are supported using the same bowl

4. Specifications

TRINITTE has a lineup of 3 distinct types of bowl sizes according to the size of the workpiece. **Table 1** shows the main specifications.

Table 1 Specifications

Part number		K-UP301	K-UP302	K-UP303
Dimensions		Length 350 mm Width 350 mm Height 320 mm	Length 500 mm Width 500 mm Height 370 mm	Length 700 mm Width 700 mm Height 510 mm
Bowl diameter		ϕ190 mm	ϕ320 mm	ϕ420 mm
Power supply voltage		AC200 V 50/60 Hz		
Mass		38 kg	85 kg	200 kg
Rotating disk	Outer diameter	ϕ344 mm	ϕ494 mm	ϕ694 mm
	Rotational count	1.3 to 6.5 min^{-1}		
	Rotational speed	0.05 to 0.20 m/s		0.05 to 0.30 m/s
Part number of controller for bowl feeder (manufactured by **NTN**)		K-ECL25		K-ECH45
Part number of controller for motor (Manufactured by Oriental Motor)		DSCD15JC		
Encoder part number (Manufactured by Omron)		E6B2-CWZ1X 1000P/RO.5M		

5. Summary

This paper explained the outline, features, and specifications of TRINITTE.

In the future, we will investigate new applications of use, such as special uses that matchuser requirements and the development of new sizes.

The Precision Equipment Division will work on supporting the changing situation in which workpieces are becoming more diverse, such as their increasing miniaturization and complexity, and achieve stable and continuous operation for the supply of parts so that we can continue to contribute towards the automation of production equipment using robots.

Photo of author

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