

「環」我「清」白

—創新性LCD玻璃基板表面清潔裝置設計

A Novel and Green Design of the Non-Powered
and Synchronous Brush Device for Cleaning LCD Panel

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關鍵詞

- 免動力源 non-powered
- LCD 面板 LCD panel
- 同步化 synchronous
- 綠色科技 green technology

摘要

本文係利用磁性環的物理能量轉換原理及磁力傳動模組之設計技術，創新設計一免動力源玻璃基板表面清潔裝置，該載具設有一具有 N 極、S 極交錯排列磁區之磁性件，而且毛刷設有一具有 N 極、S 極交錯排列磁區之磁性環，當該載具通過該毛刷時，利用載具上的磁性件與毛刷上的磁性環之間的磁力作用，來讓毛刷產生同步轉動以進行表面清潔作業，因此不需要任何額外的動力源來進行清潔作業。

本設計結合磁性環、三相感應馬達、三相 NFB 控制面板按鈕、強力磁鐵磁性件及減速器等，建構 LCD 玻璃基板免動力源同步化表面清潔裝置。因毛刷僅當玻璃基板通過時才會因磁力交互作用被驅動而同步轉動，確可因隔離傳動而減少振動及不必要額外能源的產生，當沒有載具通過時，毛刷是停止不會轉動的，符合「節能減碳」的綠色科技；其創作精神相當符合本文名稱：「環我清白」之意涵，既能兼顧「環保意識」，又能達到 LCD 玻璃基板「表面清潔」之功效。

The paper presents a novel green and clean design of the non-powered brush device for cleaning LCD panel for effective removal of foreign particles after grinding the LCD panel. In general, the cleaning device is provided with a plurality of brushes over a substrate to be cleaned, driving shaft for holding and rotating the brushes, a independent driving motor for rotating the driving shafts, a plurality of transfer rollers under the

substrate for transfer of the substrate. The cleaning device rotates the brushes in a direction, the same with, or opposite to, a direction of movement of the substrate for cleaning the substrate.

However, the cleaning device has the following problems in removing foreign particles on LCD panel. Firstly, the cleaning device includes two independent motors for driving the movement of the brushes and the substrate, respectively. As a result, it needs more hardware cost and two driving motors. Secondary, although no substrate is passed to be cleaned, the brushes still rotate and operate. Consequently, it results waste of energy and “green and clean technology” for environmental protection is not satisfactory. Thirdly, the movement of the brushes and the substrate may non-synchronous, and it results slipping friction, instead of the original rolling friction. The slipping friction force may damage the microscopic surface of the LCD panel.

Accordingly, the paper presents a novel design of a non-powered, self-driven, and synchronous brush device design for cleaning LCD panel by applying magnetic energy transfer. The new design requires no additional energy and hardware cost for driving shaft for rotating brushes, such as oil or electricity, or such actuators as driving motors. Moreover, the cleaning brushes of the present facilitates will be self-driven and synchronous with moving speed of the substrate only for the removal of foreign particles from LCD panel as necessary. In other situations, the brushes stop to save energy and raise the energy efficiency. Therefore, the novel

cleaning device may be designed for removal of foreign particles not only from the viewpoint of hardware cost, but also from green technology issue.

前言

面臨節能減碳呼聲不斷上漲及全球金融風暴衝擊下，各大企業莫不以降低成本、提高效率與品質為優先考量，日本豐田集團子公司愛信(AISIN)生產技術本部工業研究所池田重晴先生，近年大力鼓吹「活用於生產支援的無動力自動化搬運裝置」議題，池田所長曾在 Discovery 頻道主持過產業自動化節目，堪稱「無動力自動化」的先驅學者，池田先生長期鑽研日本固有「端茶玩偶」技術傳承，並進一步發揚光大成「無動力自動化」理念，就是無需憑藉煤、電、油、空氣等動力能源，而是利用物體本身的動能、位能、磁能等能量之間成功轉換而達到生產及搬運目的，此創新技術概念更榮獲日本政府頒發「第一回日本製造大賞特別賞」獎勵。池田所長立足現場生產支援的立場觀點上，衍生出的池田流「工藝開發」的思考模式，主要精神就是建立「無動力思想」及「多元同步動作思想」的運用實務，池田所長已對豐田生產管理系統成功開發出無動力搬運台車及無動力自動生產裝置，具體落實企業「節能減碳」政策與「減少人力、物力」成本觀念([1],[2])。

觀察傳統動力傳輸裝置大都採用齒輪或皮帶等接觸式零件來達成，但其在運轉過程中，接觸面會有相對的運動及磨耗產生，長時間下來將產生粉塵粒子，這對強調高潔淨度或無塵室的工作條件，將對後續製程造成極大的困擾，所以必須

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