

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202511042952 A

(19) INDIA

(22) Date of filing of Application :03/05/2025

(43) Publication Date : 23/05/2025

(54) Title of the invention : A MAGNETIC NANOPARTICLE DISPERSION DEVICE FOR TARGETED MATERIAL REINFORCEMENT

(51) International classification :B01L0003000000, B01F0025433000, B82Y0040000000, B01F0023410000, H01F0001000000

(86) International Application No :NA  
Filing Date :NA

(87) International Publication No : NA

(61) Patent of Addition to Application Number :NA  
Filing Date :NA

(62) Divisional to Application Number :NA  
Filing Date :NA

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(57) Abstract :

A magnetic nanoparticle dispersion device includes a reservoir (12) containing a nanoparticle suspension (22), a pump (10), a programmable magnetic field generator (11), and an outlet nozzle (24) for precise material reinforcement on substrates (26). The device directs nanoparticles to specific zones using real-time magnetic alignment and microfluidic control, improving localized strength. This modular, programmable device enhances reinforcement precision in structural materials, enabling automation, reduced waste, and improved mechanical performance through controlled dispersion of magnetic nanoparticles.

No. of Pages : 15 No. of Claims : 5