A 3-D printed waffle slab assembly and method thereof

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PROBLEM STATEMENT

- Conventional 3D printing elements are having challenges like **costlier process, installation difficulties**, unable to use for bigger structure printing such as roof slabs.
- Moreover, the construction of waffles slabs requires using a formwork, which has **multiples components** like waffle pods, horizontal supports, vertical supports, moulds, steel bars, etc. The usage of the formwork results in **extra expenditure** of **time, money & resources**, which makes the process very difficult, slow & inconvenient.
- Hence, there is a need to address the issues.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2130; IN Patent No:499903

TECHNOLOGY CATEGORY/ MARKET

Technology: 3D printed waffle slab assembly;
Industry & Application: Infrastructure, Civil, Construction buildings;
Market: The global waffle market is projected to grow at a **CAGR** of **9.3%** during **2024-2032.**

TRL (TECHNOLOGY READINESS LEVEL)

TRL-4, Proof of Concept ready, tested in lab.

TECHNOLOGY

- Present invention describes a **3D-printed waffle slab assembly** and **construction method.** (Refer Figures 1 & 2)
- The assembly is made up of **3D-printed components** such as **waffle bases, waffle cups,** and **shear locks**.
- The **waffle base** has a **first plate, outer** and **inner vertical projections.**
- The waffle cup has a **second plate** and **vertical walls**, wherein said waffle cup is placed in an **inverted position** over the **waffle base.**

IMAGE

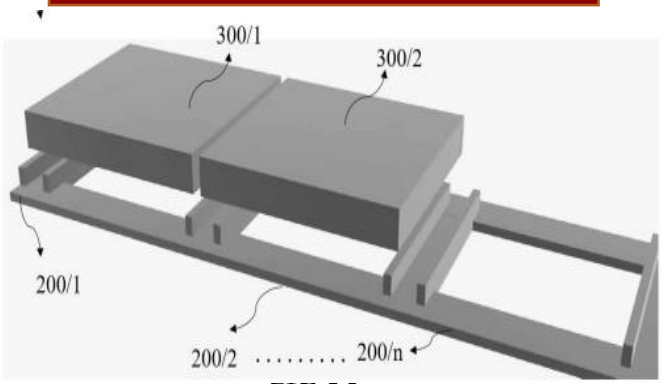

FIG.1A

- The **shear lock** is **inserted** into the **cavities** of the **formed waffle slab** to connect the **top and bottom flanges** of the slab and **transmit shear stresses**.
- Further, claimed invention describes a **method for constructing a 3D-printed waffle slab assembly,** wherein method involves **3D-printing**, the required number of waffle slabs, waffle cups, & shear locks.
- The waffle bases are laid **side-by-side** on a flat surface, & a fixing material such as **grout** is poured into the cavities.
- Thereby, the waffle cups are placed in an inverted position over the grout-layered waffle bases to form the **waffle slab assembly.**
- **Reinforcement bars** are placed in the gaps between the waffle cups, & the fixing material such as grout is poured to fill all the cavities of the waffle slab assembly up to half the depth.
- The 3D-printed shear locks are then inserted, & distributer bars are placed on top, finally a **fixing material** is poured into the space above the flat surface of waffle cup.

RESEARCH LAB

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KEY FEATURES / VALUE PROPOSITION

❖ *Technical Perspective:*

- Claimed constructional method, for waffle slab assembly using 3D-printing, **does not require formwork.**
- Facilitates an **efficient load carrying structural slab**.
- The construction method uses 3D-printing to facilitate the construction of a **large span waffle slab assembly.**
- Provides effectively & accurately 3D-printing small pieces & assembling for **efficient load transmission in the waffle slab assembly.**
- The formed waffle slab assembly can be lifted and placed at **required positions for building construction**. (Refer Fig. 2 & 3)
- Claimed invention provides a method for constructing the shear lock, wherein said shear lock is to resist shear forces within sections of the waffle slab assembly.

❖ *Industrial Perspective:*

- The claimed waffle slab assembly allows for an **efficient and faster construction buildings.**
- The constructional method comprises **constructing a waffle slab** using **3D printed components**, which can be built in **cost-effective** manner & thereafter transported to building construction sites.
- Advantageously, in 3D-printing the components of the waffle slab assembly allows to **efficiently optimize shapes of waffle slab**.
- Allows to design waffle slab components with **more flexibility,** of **any size** and in any **geometric shape**.

IMAGE

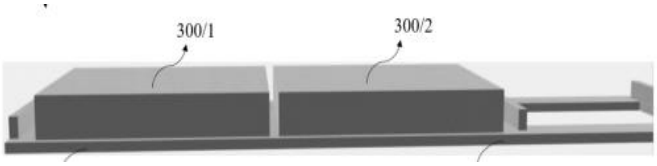

Fig. 2(Above): Depicts the 3D-printed waffle slab assembly with waffle cups placed on waffle bases,

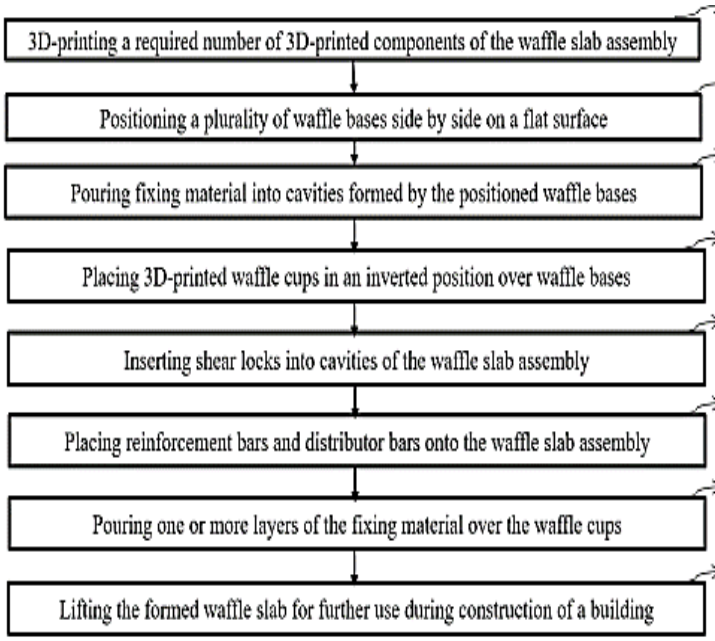

Fig. 3(Above): Depicts the method for constructing a 3D-printed waffle slab assembly;

Exemplary Embodiment

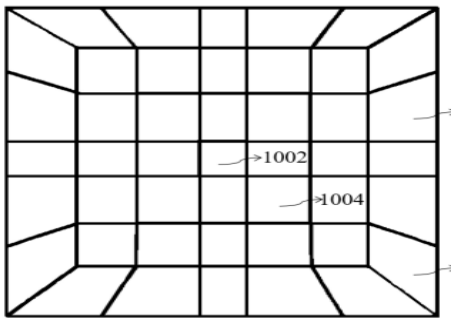

Fig.4: Depicts exemplary embodiment of the waffle slab assembly.

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