

The Investigation of The Different Types of the Ground Rebar Spacers with Proposing New Design Rebar Space Mixed of Concrete Palstic

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Abstract

The reinforcing spacers are commonly prepared from cementitious material, plastic or metals. These spacers are prepared to provide the reinforcing steel with ensuring that the requested concrete cover thickness is attained to guard surrounded steel from corrosion. Also, they pretend a vital role in the concrete structure performance. The toughness of reinforced concrete buildings remains extremely reliant on the features of the protection of concrete to be strong with thickness. A disappointment in finding cover thickness is considered the main impact on early deterioration within the steel, whichever in chance is a chief weaken method in reinforcing concrete constructions. The specified study offerings a review study on the investigation of the advantages and disadvantages of six factors in various types concerning the ground rebar spacers studies. As a result, different types of ground rebar spacers have been compared and the new rebar spacer has been designed mixed of concrete_ plastic material

Keywords: Rebar spacer, concrete-plastic rebar spacer, ground spacer, new design of rebar spacer

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I. INTRODUCTION

A rebar spacer is the main tool in securing the reinforcing steel or "rebar" in strengthened concrete constructions as the rebar is gathered in place previous to the last concrete discharge. The spacers are left-hand in place for the dispense to retain the strengthening in place and develop as a permanent portion of the construction. Spacers are indispensable apparatuses in reinforced concrete constructions. A purpose is the protecting the reinforcing of steel in the precise location inside a formwork and stopping of moving the preceding toward and then throughout the concrete. As a result, the compulsory protect is gotten of the ended structure. The size of the spacer governs the size of the cover deepness to strengthening, so in the organizational plan, it remains as a distinct rendering to the strictness of exposing the atmosphere, requested the toughness and firefighting. Attaining the satisfactory deepness and quality of the concrete cover are serious as they defend the enclosed steel strengthening from the outside atmosphere. It is familiar that insufficient protection is the main feature producing untimely corrosion of strengthening, and a main shape of deprivation of concrete

structures. In the construction project, it is supposed that attaining the stated cover confirms that the as-built construction attains the predictable design routine in terms of toughness, firefighting, and serviceability.

Plan standards and codes of preparation for concrete constructions necessitate a spacer to be situated for every meter (or less) lengthways of span of strengthening bars to guarantee the bars stay in-home throughout concreting. Consequently, a characteristic concrete of the structure covers numerous spacers [1, pp. 7973–1].

In spite of the clear necessity of spacers, up and about today, very limited essential researches have been investigated on the impact of the spacer on concrete microstructure and long-term presentation. The initial research on the microstructure of spacer-concrete crossing point by means of the backscattered electron (BSE) microscopy was described by the authors of the study [2]. The paper discovered that the attendance of spacer outcomes a micro-cracked and extremely permeable boundary, which quickens the entrance of gasses and liquids over concrete protection. Though, the work

individually concentrated on concretes covering Portland cement CEM I as the chief folder. In this research 13 studies of various types of ground rebar spacer have been investigated in order to distinguish the advantages and disadvantages of each type considering the most important type among others. Also, the new design ground spacer has been distinguished. The specification of every rebar spacers as can be seen in Table I. presenting advantages and disadvantages of 13 different papers investigating ground rebars spacers according to five factors, cost. Size, assembly step, clamp, weight, manufacturing. Also, the dimensions of a new design parameter of Plastic _ Concrete a spacer as in Fig. 1.

TABLE I. ADVANTAGES AND DISADVANTAGES OF 13 DIFFERENT PAPERS INVESTIGATING GROUND REBARS SPACERS ACCORDING TO FIVE FACTORS: COST, SIZE, ASSEMBLY STEP, CLAMP, WEIGHT AND MANUFACTURING

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	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	Pros	Cons	
Cost		×	√			×		×	√		√			×	√		√		
Size	√		√		√			×		×	√		√			×		√	
Assembly step	√		√		√			×		×	√		√		√		√		
Clamp	√			×	√		√		√			×	√			×	√		
Weight	√		√		√			×		×	√		√		√				×
Manufacturing		×	√			×		×	√		√			×		×	√		

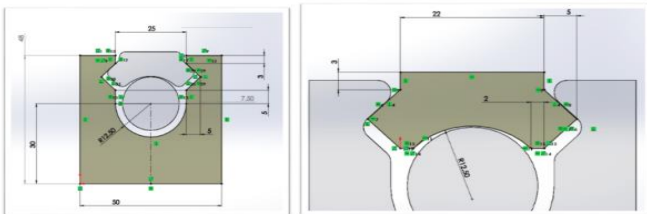


Fig. 1. New design parameter of plastic concrete spacer

A. Criteria and Requirements of the Performance

The performance perception could be practiced to various decay with combination to stages of building projects: the construction with its parts, its basics, apparatuses, and resources [3]–[5] [6]. Creating performance with a communal global repetition that uses as an explanation of necessities

(qualitative), standards (quantitative) besides evaluation approaches to allow its pure dimensions [7].

Rendering to ABNT NBR 15575 [7], performance necessities are situations that qualitatively express the characteristics which the production should own to encounter the necessities of the operators. Performance values are quantitative conditions of performance supplies, stated in the relation of assessable amounts. As a result, they could be accurately determined. By this inattention, a Brazilian standard built on the performance which a complete erection is wanted. Though there is a space in this respect regarding the spacers, and the nonappearance of Brazilian principles of modifying them stops the switch of management the specified substantial, allowing the emergence of insufficient goods on the market. By the nonappearance of Brazilian criteria, it was projected performance supplies and standards, from time to time depending on a global standard, other areas affecting them with original necessities and standards [8]

B. Dimensional

The dimensional necessities with standards are recognized relied on European standard CEB Communiqués #201 [9], [10] and British Standard BS 7973-1 [6] prepared from adding a single cover value or at greatest two cover principles for the similar spacer (British Standards Institution (BSI) [11], [12]. It prevents mistakes in its applied steps, anywhere the problem of its settlement produces unnoticeable alterations in its cover, as exemplified in Fig.2guaranteeing the insignificant cover [7].At the end, the spacer protection should be exactly offered through the constructor at the period of its usage, through an acceptance of ± 1 mm for covers up to 75 mm and ± 2 mm for greater covers [9]–[11]. The spacer should own this measurement from the sustenance base until the last placing of the braces in it [11]. Also, for representations that are immovable by the assistance of chains (seats and multi-support insertions), their dishonorable should be at minimum 20 mm and at maximum 350 mm. They determined in such a way an equivalent to the firming bar, and at smallest 0.75 of the magnitude of the cover determined vertical to the bar, rendering to the rules Fig. 2.a. For round representations, the center of the provision anywhere the bar is equestrian as in Fig. 2. b. has to offer a thickness superior to 0.5 of the providing cover.



(a) straight (b) upside down

Fig. 2. Dimensional performance and least dimension necessities [13]

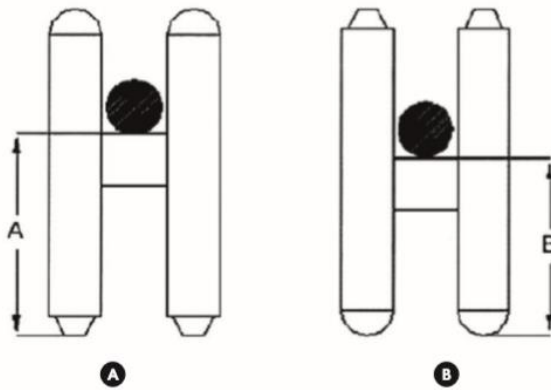


Fig. 3. Spacer example containing two propable submission locations: a) straight (b) upside down [14] [13]

C. Identification

An invention must be simple to recognize, which is the size of the insignificant cover that should be obviously shown on the creation itself [12, p. 1]. Though no usual necessitates of the spacer to be acknowledged, outside the documentation of the creation's cover. Once, the similar method is worried, through dissimilar cover standards, these should have discrete colors as designated in this method [4].

D. The Fixing stage

A spacer should have the capability to fix the strengthening bars and fight a movement of a steel bar by a load of 5 N [9]. As such, each spacer should own a combined fix component so that it will assign to the help, deprived of plummeting or trailing its purpose, as exemplified in Spacer example containing two propable submission locations: a) straight (b) upside down [14]. Spacers that came loose of the reinforcement, no longer performing its function. The fixity piece (as wire use) must not be the accountability of the team in control of the meeting of reinforcing concrete. Since this would reason the hazard of it not being performed. That is the reason that a combined fixity is essential

E. Stability

The spacer should take at least constancy. As a result, once be compulsive throughout a concreting process, it stays undertaking its portion, preventing difficulties such as tilting, as shown in Fig 4.



Fig. 4. Spacers which originated loose from the reinforcing, no longer accomplishment its purpose [13]

F. Load capacity

The spacer should continue completely throughout the concreting procedure, fighting the weight in which it is unprotected - like the heaviness of reinforcing, the assemblage

with concrete processes, a heaviness of labours with apparatuses, amongst others - with a least assessed weight of 3,0 kN [9]. For spacers facing excessive demands, like those recommended in concrete slabs and beam bottom (chair-type and numerous provision spacers), and a least load of 0.25 kN (light strong point recommended by the CEB Bulletins# 201 [9] and by [11] for spacers usage on the edges of basics, such as round spacers. These loads should be attacked below a supreme linear permanent distortion, in the way of the cover, of 1 mm, preventing conditions like in Fig. 5.



Fig. 5. Spacer that fell throughout a concreting process [13]



Fig. 6. Spacer deformation due to service loading [13]

G. Application

The spacer should be simply appropriate to steel bars, similarly, with no necessity of a competent worker for its submission. At the end, it must not need extra than 0,15 kN (weight practised by any adult) [15], [16]. It's the location to the main diameter of the bar stated by manufacturing [9] as shown in Fig. 6.

II. TYPES OF GROUND REBAR SPACERS

A. Spacer for reinforcing bar installation

The present invention relates to a doughnut-shaped spacer, maintaining a predetermined distance between a reinforcing bar and a mould to install the reinforcing bar in a concrete structure[5], [4], [17] as in Fig 7. Whereas an existing spacer increases the distance between the reinforcing bar and the mould due to the increase in the outer diameter of the spacer when the reinforcing bar becomes thicker as in Table I. Advantages and Disadvantages of 13 different papers

investigating ground rebars spacers according to five factors. Cost. Size. Assembly step. Clamp. Weight. Manufacturing.

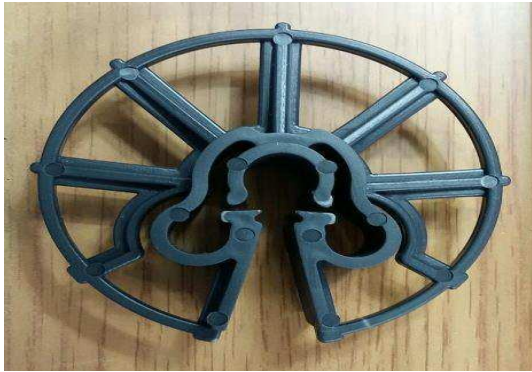


Fig. 7. Doughnut-shaped spacer

B. Spacer and manufacturing device thereof

The present invention relates to a doughnut-shaped spacer, maintaining a predetermined distance between a reinforcing bar and a mold to install the reinforcing bar in a concrete structure as Spacer and manufacturing device thereof . Whereas an existing spacer increases the distance between the reinforcing bar and the mold due to increase in the outer diameter of the spacer when the reinforcing bar becomes thicker, the spacer of the present invention enables the thick reinforcing bar to be not influential to a central edge while allowing a reinforcing bar storage to be unfolded even

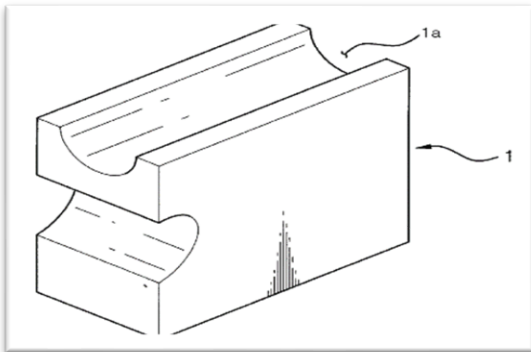


Fig. 8. Spacer and manufacturing device thereof

C. Concrete products locking cage spacer

This spacer is completed of plastic in the wheel shape by bars that which is joining to outer ring by an inner ring that involves a horizontal wire as in Fig. 9. The rings take holes to add for setting up the spacer on a crate wire. A hole in the outside circle is locked by a handle which appropriately involved, will lock the spacer in home on the wire, therefore positively hold the spacer on the cable when it is protected in home.

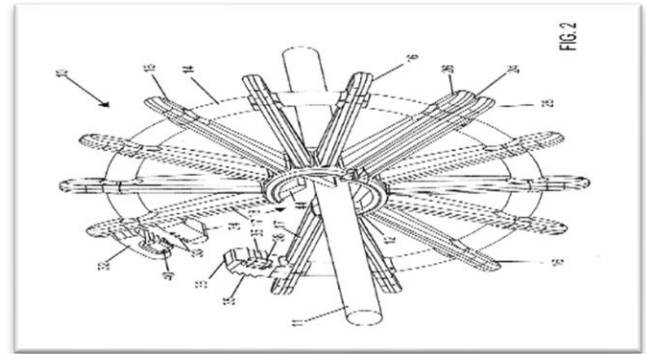


Fig. 9. Concrete products locking cage spacer

D. Spacer capable of adjusting position and height of vertical and horizontal rebar

The present invention relates to a spacer that capable of adjusting a position and height of a vertical and horizontal rebar. The purpose of the present invention is to enable a user to control height and prevent deformation of a vertical and horizontal rebar due to a load as in Spacer capable of adjusting position and height of vertical and horizontal rebar. According to the present invention, the spacer is capable of adjusting a position and height of a vertical and horizontal rebar .

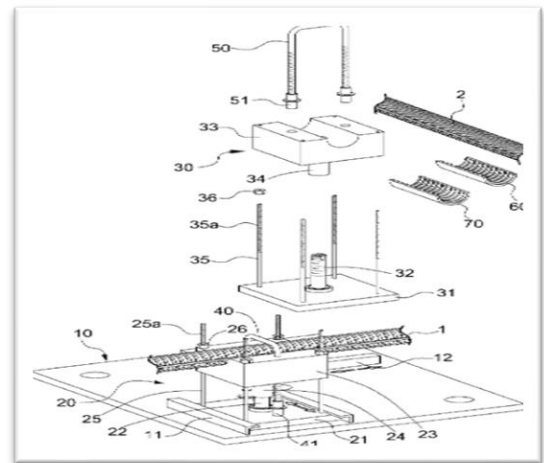


Fig. 10. Spacer capable of adjusting position and height of vertical and horizontal rebar

E. Spacer capable of keeping the distance between a reinforcing bar and a reinforcing bar, or, a reinforcing bar and the concrete bottom

A spacer is provided to keep the interval between a reinforcing bar and another reinforcing bar, or, a reinforcing bar and the concrete bottom regularly by seating a reinforcing bar in a housing groove. Executing a bar arrangement quickly by excluding the necessity of an additional coupler for a spacer and a reinforcing bar as in Fig11.

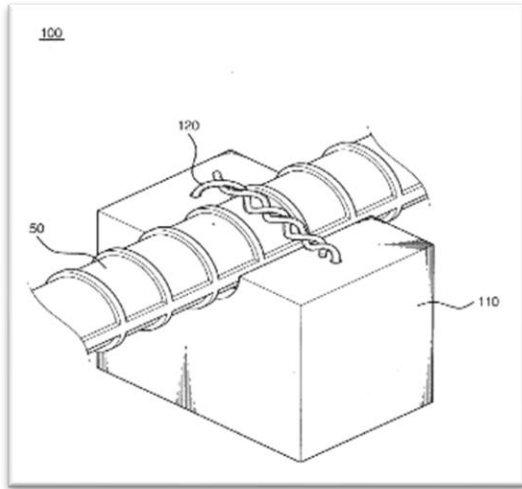


Fig. 11. A spacer is provided to keep the interval between a reinforcing bar and a reinforcing bar, or, a reinforcing bar and the concrete bottom

F. Spacer with visual confirmation

The present invention relates to a spacer capable of visually checking the specification as in Spacer with visual confirmation



Fig. 12. Spacer with visual confirmation

G. Bar reinforcing wheel spacer :

In order to use a spacer wheel in constructing by reinforcing rods cast into a complex such as concrete. The spacer wheel is organized to offer a space of a reinforcement rod from neighboring sides as the concrete is a group of performers into growth as in Fig13. The wheel of the spacer is of three portions plan and has a base piece and leftward and right pivotable pieces. The spacer wheel usages an inherently formed pivot to link each pivotable segment to the base segment. The enterprise likewise usages a double rack and hand instrument to lock the spacer wheel onto the reinforcing rod.

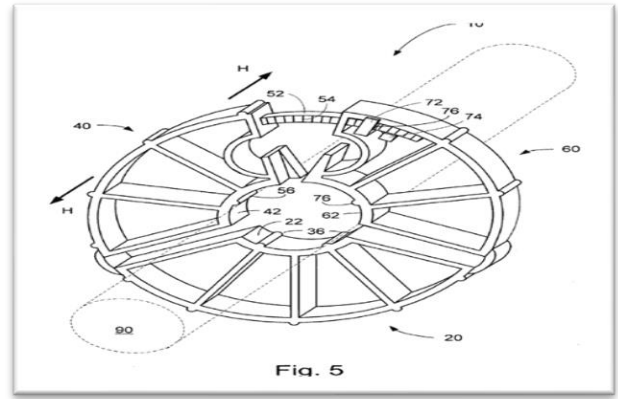


Fig. 13. Reinforcement bar spacer wheel:

H. Spacer for rebar placement of building

The present invention relates to a spacer for arranging reinforced bars of a building, and more particularly, to a spacer of arranging slab reinforcing bars of a building. This is to reduce costs and improve productivity at the same time as in Spacer for rebar placement of building 14 [18]

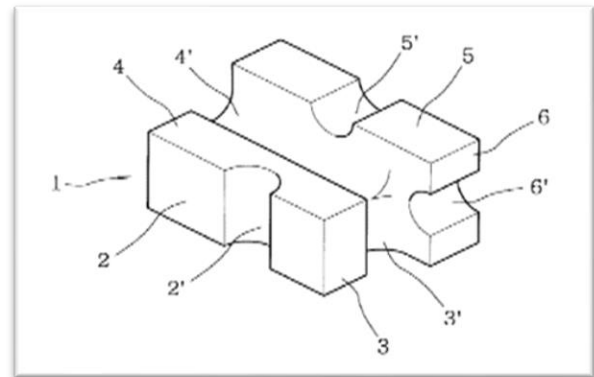


Fig. 14. Spacer for rebar placement of building

I. Detachment spacer

The present invention is formed vertically in the center at the upper and lower portions of the rectangular parallelepiped, the upper and lower reinforcement grooves (1, 2) to insert the reinforcing bar, and vertically formed at the center of the left and right sides. The binding material for binding the reinforcement is inserted. It relates to a separation prevention spacer consisting of the side binding insert grooves (3,4) as in Detachment spacer [19]

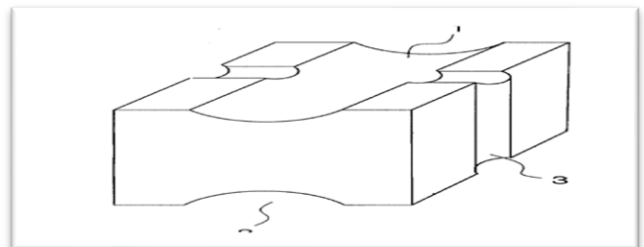


Fig. 15. Detachment spacer

III. CONCLUSION

No specific ground spacer model assessed and showed to be reasonable for all requirements and standard projects.

The supplies and performance standards used as a suitable way to assess the performance of the pieces. The spacers might be measured as one of the possible features of not attaining the project cover on present structures. It can be seen, that all and any obligation and standards established can be fulfilled since there are many advantages and disadvantages of each type of the investigated ground spacers. In our study, the manufacturing and clamp have repeated 6 times as disadvantages followed by weight, size and cost 5 times. The Assembly Step has 2 times repeating and representing the minimum number among other factors. The Assembly step has 11 ranks among others followed by size, weight and cost which has 8 times alterations among other features. Manufacturing and Clamp have the least number which is 7 times as an advantage.

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