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REINFORCED-CONCRETE STRUCTURES SERVING TO LIMIT VIBRATORY OSCILLATIONS OR TO PREVENT THE SAME

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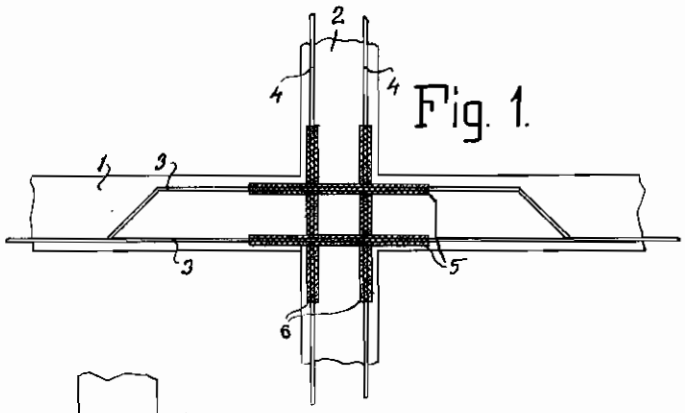

Fig. 1.

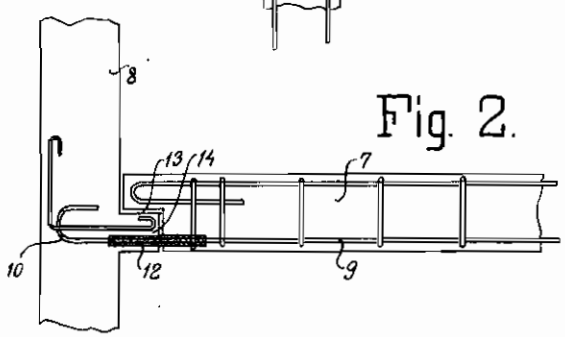

Fig. 2.

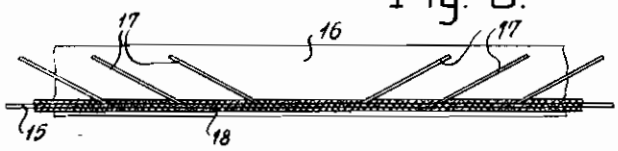

Fig. 3.

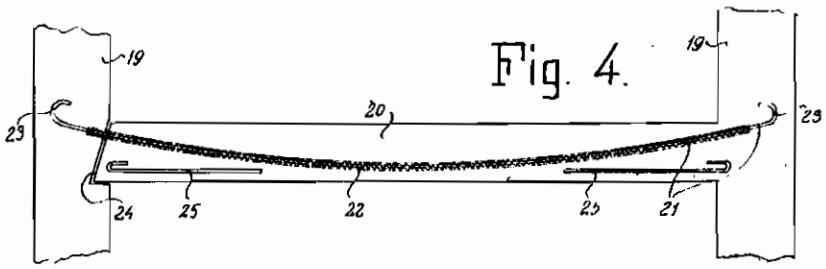

Fig. 4.

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ALIEN PROPERTY CUSTODIAN

REINFORCED - CONCRETE STRUCTURES SERVING TO LIMIT VIBRATORY OSCILLATIONS OR TO PREVENT THE SAME

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It is a common experience that house-building structures of reinforced concrete which as a rule largely consist of relatively thin floor slabs and walls are likely to come into undesirable vibrations and oscillations. These vibrations are due to a molecular-physical reaction and elastic deformation in the reinforced concrete, and they may be released or produced by direct mechanical actions, for instance the transmission of vibrations from street traffic, wind pressure or air-pressure variations in the room concerned, for instance the action of sound. Owing to the monolithic character of the reinforced concrete, the reaction and the elastic motion may propagate themselves very widely throughout the structure, and owing to resonance effect and the like, the elastic deformation, the elastic deformation work and the accompanying dynamic intensity development will become amplified, and thus the oscillations will be subject to a volume expansion, and the conditions of air pressure in the closed rooms of the building concerned will become disturbed in a very undesirable manner.

The said molecular-physical reaction and elastic motion in the reinforced concrete will form longitudinal as well as transverse waves, and elastic flectional oscillations at the floor and wall slabs are produced causing the said elastic systems to become active as oscillation carriers for sound waves, and the sound insulation between the rooms concerned will become unsatisfactory.

An important cause of the propagation and amplification of the reaction and the oscillations is due to the practically coherent iron reinforcements which very willingly propagate the oscillation impulses received, and transmit the same to the surrounding concrete, and vice versa.

At the stiff corner connections, between for instance horizontal and vertical structural units, for instance story-separations (floor slabs) and walls, or for instance vertical columns and horizontal beams, nodal points will be produced at which the elastic deformation involves an especially powerful dynamic development of force acting on the rigidly coupled slab units and columns or beams, and thus the undesirable flectional oscillations are forced into existence.

The invention has for its object to regulate the molecular-physical reaction, in such a manner that the same becomes suitably limited, and in order to prevent an undesirable dynamic development of power at the structural units, the elastic deformation work is absorbed by means of plastic coupling devices serving to prevent any elastic deformation in an iron or concrete unit from causing a mutual action and a united dynamic development of power.

By means of plastic coupling devices, the physical co-opeartion is subdivided in such a manner that perhaps every individual slab unit, for instance floor slab or wall slab receives its own local basis of reaction and oscillation, in such a manner that the solid reinforced-concrete building does not any more form a coherent rigid unit, but that on the contrary the existing plastic coupling devices will prevent a direct transmission of stresses from one structural member to another, after which the entire building will be able to counteract pressure and shocks by a damped yielding motion adapted to absorb the acting motional energy.

This result is attained by a more or less complete uncoupling of the iron parts of the structure from the concrete, in such a manner that any oscillatory co-operation between these two materials, which are widely different in respect to elasticity, will be avoided or reduced, and the tendency of the known building structures of the kind concerned to increase the vibrations beyond the order of magnitude of the initial impulse owing to resonance conditions and the like may thus be annihilated or reduced.

According to the invention, the above subdivision of the building structure is attained by surrounding the reinforcing rods, at certain places, with a plastic covering. This covering which for instance may consist of bitumen or mixtures of asphalt and caoutchouc, or of layers of for instance linen, jute or paper mass permeated with such a plastic material, or of a lead coating, will partly create a nodal point for the oscillations and partly absorb the same and convert them into heat, in such a manner that their further propagation through the iron, or to the surrounding concrete, will be prevented.

According to the invention, it is especially preferable to dispose the plastic coating at places where the various structural units, for instance floor slabs and walls, cross each other, or are joined. Thus, in a story-separation, the length of the reinforcing rods that projects into, or through, the supporting walls may be coated with a plastic layer which also covers the nearest part of the reinforcing rods situated outside the wall. If also the supporting wall itself is made from reinforced concrete, it will be preferable, according to the invention, to fit the vertical reinforcing rods of the wall with a plastic coating on a stretch situated opposite the floor slab and some distance above and below the same. In the case of an end support for a story-separation or other structure the reinforcing rods of which must be anchored firmly in the concrete mass of the support, the reinforcing rods according to the invention may be coated with plastic material on the stretch next to the wall and some distance into the wall, while the possibly hooked end of the reinforcing rod that serves to anchor the same is uncoated. However, also the part of the reinforcing rod that serves as an anchorage may be fitted with a plastic coating, provided that a sufficiently firm and strong material, such as lead,

be used for this purpose, in such a manner that the forces can be transmitted by way of the same, between the iron and the concrete.

By the above mentioned coating of the reinforcing rods, at the place where the story-separation and the wall are joined, the transmission, between wall and story-separation, of the oscillations occurring in the interior of the monolithic structure as well as of plate oscillations will be reduced. Similarly the transmission of oscillations between two story-separations situated on either side of a wall acting as an intermediate wall, with reinforcing rods running through the intermediate support, will be prevented or greatly reduced.

As far as oscillations or vibrations are concerned the walls and story-separations of the individual rooms will therefore behave mainly as if they did not have any oscillation-transmitting connection to the adjoining structural members or to structural members integral with the same. This separation between the story-separation and the supporting wall may be completed more or less, in a manner known per se, by the provision of a joint, in the concrete mass, filled with plastic material.

Instead of, or besides, at the ends the reinforcing rods may be fitted with a plastic coating along shorter or longer parts of their length situated between the supports, for instance along this entire length. Thus a very efficient prevention of oscillations in the reinforcing rods will be attained, and further the solid concrete mass will thus be fitted with oscillation-absorbing chords or layers which partly, as nodal lines or nodal surfaces, will prevent the occurrence of considerable plane oscillations of the story-separation, and partly will give the latter a greatly increased ability to resist the passage of sound, whether the same be air sound or blow sound.

While for instance a plastic coating of lead will be able to transmit the requisite transverse forces and adhesion forces from the concrete to the reinforcing rods, this will not always be the case with other plastic materials, such as for instance bitumen, and by the use of such a coating which does not have the mechanical strength required for the transmission of adhesion forces and shearing forces, it will therefore be necessary either to leave so large stretches of the reinforcing rods uncoated that the requisite transmission of forces can take place, or to use reinforcing rods with expanded parts or the like which render superfluous the presence of any real adhesion between concrete and iron, for instance rods with knobs or reinforcing rods with welded or partly severed flaps bent upward, for instance Kahn-rods.

If the inserted reinforcing rods are shaped mainly as a funicular polygon or curve corresponding to the load distribution, the above mentioned problem concerning the transmission of adhesion forces between the concrete and iron will be avoided and the entire length of such a reinforcement may be coated with plastic bitumen or the like, it being merely necessary to provide a firm anchoring of the ends of the reinforcement.

The drawing shows, in outline, a few examples of the process according to the invention.

Fig. 1 shows, in vertical section, a portion of a floor slab (story-separation) and a wall serving as an intermediate support,

Fig. 2, in vertical section, a portion of a story-separation and a supporting wall,

Fig. 3, in vertical section, a portion of a story separation, and

Fig. 4, in vertical section, a story-separation and part of the supporting walls.

In Fig. 1, 1 indicates a floor of reinforced concrete with reinforcing rods 3 running unbroken through a supporting wall 2, similarly of reinforced concrete, with reinforcing rods 4. On the part of the reinforcing rods 3 passing through the wall 2, the rods are given a plastic coating 5 of the above described nature and, correspondingly, the reinforcing rods 4 of the wall are fitted with a plastic coating 6 at the place where they cross the floor slab 1.

Fig. 2 shows the end of a floor slab 7 of reinforced concrete which is supported by a wall 8 made from concrete. The main reinforcement 9 of the plate 7 is formed, at the end, like a hook 10, and is anchored here in the wall 8. On the part situated next to the wall of the reinforcing rod 9, and for some distance into the wall, the rod is fitted with a plastic coating 12. Similarly, a joint 13 filled with plastic material is provided in the concrete mass, and forms a separation between the concrete in the slab 7 and in the wall 8.

The joint 13 is arranged in such a manner that it communicates with the coating 12, and that it provides a bracket 14 supporting the slab 7, which bracket may be separately reinforced as indicated on the drawing.

Fig. 3 shows a fractional part of a reinforced-concrete slab 16 reinforced with Kahn-rods 15. The upward bent flaps 17 of the Kahn-rod are directly embedded in concrete, while the remainder of the rod is fitted with a thin coating 18 of a relatively firm and partly plastic material, for instance a thin layer of asphalt. The entire length of reinforcing rod is supposed to be surrounded by the said coating.

Fig. 4 shows a reinforced-concrete slab 28 which is supported by walls 19. The principal reinforcement 21 of the slab is mainly shaped as a funicular curve corresponding to the load, and is firmly anchored by means of hooks 23 embedded in the wall 19. Along the main part of its length, the reinforcement 21 is fitted with a plastic coating 22. Besides the principal reinforcement 21, the slab 20 is fitted with a slender reinforcement 25 the main function of which is to equalize any irregularities in the loading. The said reinforcement 25 is not fitted with any coating, as, owing to its slenderness and the presence of the heavy reinforcement 21 coated with plastic material, the same will not cause any trouble. As shown at one end of the slab 20, the concrete mass of the same may be separated from the material of the wall by means of a joint 24 filled with plastic material.

While the examples described mainly indicate coatings on the individual reinforcing rods disposed at some distance from each other, there is nothing, according to the invention, to prevent the coatings from forming a mainly coherent layer for instance in the case of reinforcements with expanded metal or the like.

Obviously, the process according to the invention may be used for other structures than solid concrete structures, for instance for floors of hollow blocks, and generally for all structures in which iron, in a corresponding manner as in reinforced concrete, co-operates with a material that is able to resist pressure, such as brickwork or the like.

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