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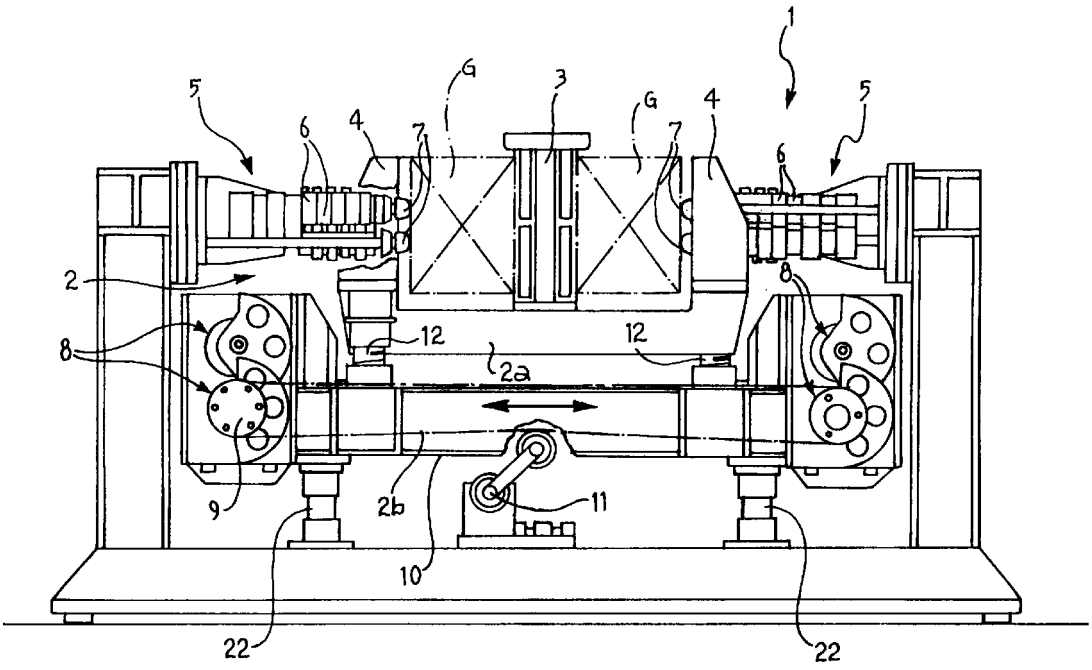
(54) Machine for decoring castings

(57) A machine for shaking-out foundry castings comprises a structure (2) for supporting the castings (G) to be shaken out, and vibrator means (8) associated with the support structure (2) for selectively vibrating the support structure (2). The support structure (2) comprises at least a first portion (2a) with associated fixing means (3, 4) for the castings (G) to be shaken out, and a second portion (2b) which is subject to the action of the vibrator means (8, 9). The first portion (2a) is supported (12) relative to the second portion (2b) as a vibrating system, and the vibrator means (8) are operable selectively (9, K) in order to bring about vibration of the second portion (2b) and vibration of the vibrating system (2a, 12) in conditions of substantial resonance.



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Description

[0001] The present invention relates to machines for shaking out (decoring) foundry castings, in particular according to the preamble to Claim 1.

[0002] Machines of this type are known in the art, as can be inferred, for example, from EP-A-0 111 461.

[0003] Some operational problems, combined with various production constraints which may be disadvantageous, may arise during the use of shaking-out machines of the type specified above.

[0004] One of these constraints is usually represented by the need to provide vibration-generating means (typically sets of eccentric elements) with associated motors of considerable power, for vibrating the support structure on which the castings to be shaken out are disposed. By way of example, in a machine usable for simultaneously shaking-out two castings constituted by internal-combustion engine blocks and/or heads, it is necessary to use an electric motor with a power of 10 kilowatts to bring about the vibration.

[0005] The use of smaller powers may lead to a shaking action which is not entirely satisfactory, and possibly to the need to perform further operations on the castings (for example, blowing with jets of compressed air, etc.).

[0006] This solution therefore involves a considerable energy consumption which also reflects in an undesirable manner on the intensity of the stresses applied to the various parts of the machine and to the machine as a whole.

[0007] Another possible problem is connected with the use, in machines of the type specified above, of percussion means constituted substantially by pneumatic hammers or equivalent means for performing a violent percussive action on the items to be shaken out - usually before vibration - to promote initial breaking-up of the sand cores to be removed from the casting by the shaking action. However, the violent percussive action exerted directly on the castings is transferred from the castings to the support structure holding them and from the latter to the vibrator means and, in particular, to the bearings of the movable elements (for example, eccentrics, etc.) included therein. Tests performed show that the percussive action has adverse effects on these bearings, possibly reducing their useful life.

[0008] The object of the present invention is to provide a machine for shaking out foundry castings in which the aforesaid problems are radically eliminated.

[0009] According to the present invention, this object is achieved by means of a machine having the further characteristics recited in Claim 1.

[0010] The invention will now be described, purely by way of non-limiting example, with reference to the appended drawing, comprising a single figure which is a general side elevational view of the structure of a shaking-out machine according to the invention.

[0011] In the drawing, a machine usable for shaking out foundry castings such as, for example, internal-combustion engine blocks or heads, is generally indicated 1.

[0012] Naturally reference to this possible field of use should not be interpreted as in any way limiting of the scope of the patent.

[0013] In Figure 1, the profiles of two castings of this type are shown schematically in broken outline and indicated G.

[0014] In particular, each casting is mounted on a support structure 2 (having the characteristics described further below) and is clamped as in a jaw between a central abutment element 3 (which is usually common to the two castings G) and an outer clamping portion 4.

[0015] It will be appreciated, moreover, that the machine 1 shown in the appended drawing, which is arranged for operating simultaneously on two castings G, has a symmetrical structure.

[0016] The following description will therefore be given with reference almost exclusively to one of the two symmetrical sides of the structure but, naturally, the side which is not described may be considered identical or substantially identical to that described.

[0017] The selection of the formation of a machine which can operate simultaneously on two castings G, as well as the use of a symmetrical structure, clearly also constitute selections which may be preferable in some situations of use but which are certainly not essential for the purposes of the implementation of the invention. In particular, the invention may be implemented with a machine which can operate on one or several castings simultaneously and which has a non-symmetrical structure.

[0018] Two percussion units, indicated 5, are constituted substantially by a plurality of percussion elements 6 (of known type), comparable to pneumatic hammers. These elements have heads 7 which, when the elements 6 are operated (by known means not shown) can perform a violent hammering action on the castings G so as to bring about an initial breaking-up of the sand cores which are contained in the castings G and are to be removed by the shaking-out action. In any case, although the solution according to the invention is intended greatly preferably for use in combination with the aforementioned percussion means, it is not *per se* restricted to the use of such means.

[0019] An important characteristic of the solution according to the invention is that the structure 2 for supporting the castings G is actually composed of two portions.

[0020] More precisely, these are a first portion 2a constituting a type of cradle on which the castings G are mounted, and a second portion 2b constituted substantially by a type of vibrating table with associated vibration means.

[0021] These means are preferably constituted, in accordance with a known solution, by sets of eccentric elements 8 rotated by a motor 9 such as an electric

motor the shaft of which acts on one of the shafts of one of the eccentric elements 8 by means of a transmission unit. The drive can be transmitted to the second set of eccentrics 8 by a further transmission, for example, of the type with a toothed belt 10 with an associated tensioning unit 11 and/or with various sets of gears. Each set of eccentrics usually comprises eccentric elements arranged in pairs of contra-rotating elements disposed in a manner such that, during rotation, they remain in a symmetrically opposed condition relative to a theoretical plane passing through the two elements. The set of eccentrics thus constantly remains in conditions of equilibrium in a direction perpendicular to the said plane, whilst the conditions of disequilibrium upon which the generation of the vibrations is based arise almost exclusively along this plane. In the solution illustrated, with the eccentrics of each pair disposed one above the other, the plane of symmetry is oriented horizontally so that the vibration stress appears mainly along a horizontal axis.

[0022] The second portion 2b of the structure 2 is supported on the ground by resilient feet or bases 22 formed in a known manner such that the activation of the eccentrics 8 corresponds to a vibration of the portion 2b along a substantially horizontal axis.

[0023] Resilient suspension elements 12 constituted, for example, by springs, buffers of rubber or similar resilient materials, etc; are interposed between the two portions 2a and 2b of the structure for supporting the castings. The elements 12 support the portion 2a resiliently relative to the portion 2b giving rise to a vibrating system also preferably having a principal vibration axis which is horizontal and hence identified by the double arrow shown in the drawings. The aforementioned vibrating system has a resonance frequency of the order, for example, of about 30 Hz, this frequency naturally being determined (and selectively determinable) principally, by factors such as the mass/weight of the portion 2a (possibly also taking account of the mass of the castings G) and the resilience characteristics of the suspension elements 12.

[0024] Basically, the operating sequence of the machine according to the invention does not differ appreciably from the operating sequence of the known machines according to the solutions recited in the introductory portion of the present description.

[0025] When the castings G have been fixed in their mounting positions on the structure 2 (particularly on the first portion 2a thereof), the control device K (for example, a so-called PLC, or programmable logic controller) which supervises the operation of the machine in known manner, activates the percussion elements 6, which are intended to perform a violent hammering action on the castings G, resulting in initial breaking-up of the sand cores to be removed.

[0026] The hammering action is continued for a certain period of time (for example 10-15 seconds) and the motor 9 is then activated so as to vibrate the support structure 2.

[0027] In general, the rate of rotation of the motor 9 is controlled (again by the control unit which supervises the operation of the machine), so as to bring about a gradual increase in the vibration frequency.

[0028] Initially, that is, as long as the vibration imparted by the eccentric elements 8 to the portion 2b of the structure 2 remains below the resonance frequency of the vibrating system defined by the portion 2a and by the respective resilient suspension elements 12, the two portions 2a and 2b of the support structure 2 vibrate together with a low amplitude, for example of about 2-3 mm.

[0029] When the resonance condition is approached by the operation of the vibration means 8 and 9 at increasing frequency, and once this condition has been reached, controlled resonance is maintained, and the portion 2b on which the eccentric elements 8 act continues to vibrate with the previous vibratory motion of 2-3 mm amplitude (naturally this refers principally to the horizonal direction), whilst the amplitude of the vibratory motion of the portion 2a which constitutes the cradle holding the castings G increases until it is vibrating (with the castings G) with a motion having an amplitude, for example, (and with reference, for example, to a portion 2a having a weight of the order of 500 kg) of 13-14 mm.

[0030] When the vibration process is considered complete (for example, after about 40 seconds) the motor 9 is slowed down, thus reducing the frequency of operation of the vibrator means from the normal operating (resonance) frequency, thus bringing the vibrating system of the portion 2a below the resonance frequency until the movement of the support structure 2 as a whole is stopped.

[0031] In order to achieve a vibratory motion of the castings G with the amplitude indicated (13-14mm) with a conventional structure, it would be necessary to use much more powerful vibrator means with a consequent considerably greater power consumption.

[0032] For example, the solution shown in the drawing provides for the use of two sets of eccentrics 8 situated on the portion 2b of the structure. Tests carried out by the Applicant show, however, that completely satisfactory operation can be achieved even with the use of only one of these sets.

[0033] It will also be appreciated that a reduction in the number of oscillators results in a corresponding simplification of the respective transmission members, possibly with a reduction in their size.

[0034] At the same time, it is also possible to reduce the dimensions, and hence the weight, of the portion 2a constituting the cradle for supporting the castings G which portion, above all, is no longer coupled to the vibration means 8, 9.

[0035] The action of the percussion means 6, the heads 7 of which act on the castings G, no longer extends to the portion 2b of the support structure, pre-

cisely because of the presence of the suspension elements 12. The support members (for example bearings) and transmission members associated with the eccentrics 8 are therefore isolated from the action of the percussion elements 6, preventing damage thereto.

[0036] Naturally, the principle of the invention remaining the same, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated, without thereby departing from the scope of the present invention as identified by the following claims.

Claims

1. A machine for shaking out foundry castings, comprising:

- a structure (2) for supporting the castings (G) to be shaken out, and
- vibrator means (8) associated with the support structure (2) for selectively vibrating the support structure (2),
  characterized in that:
- the support structure (2) comprises at least a first portion (2a) with associated fixing means (3, 4) for the castings (G) to be shaken out, and a second portion (2b) which is subject to the action of the vibrator means (8),
- the first portion (2a) is supported (12) relative to the second portion (2b), as a vibrating system, and
- the vibrator means (8) are operable selectively (9, K) in order to bring about vibration of the second portion (2b) and vibration of the vibrating system (2a, 12) in conditions of substantial resonance.

2. A machine according to Claim 1, characterized in that the first portion (2a) is supported relative to the second portion (2b) by resilient suspension means (12).

3. A machine according to Claim 1 or Claim 2, characterized in that the vibrator means (8) vibrate the second portion (2b) along a substantially horizontal axis, and in that suspension means (12) are interposed between the first portion (2a) and the second portion (2b) to enable the first portion (2a) to vibrate in a substantially horizontal direction relative to the second portion (2b).

4. A machine according to any one of the preceding claims, characterized in that the vibrator means comprise at least one eccentric vibrator unit.

5. A machine according to any one of the preceding claims, characterized in that the vibrator means (8) are mounted on the second portion (2b) of the support structure (2).

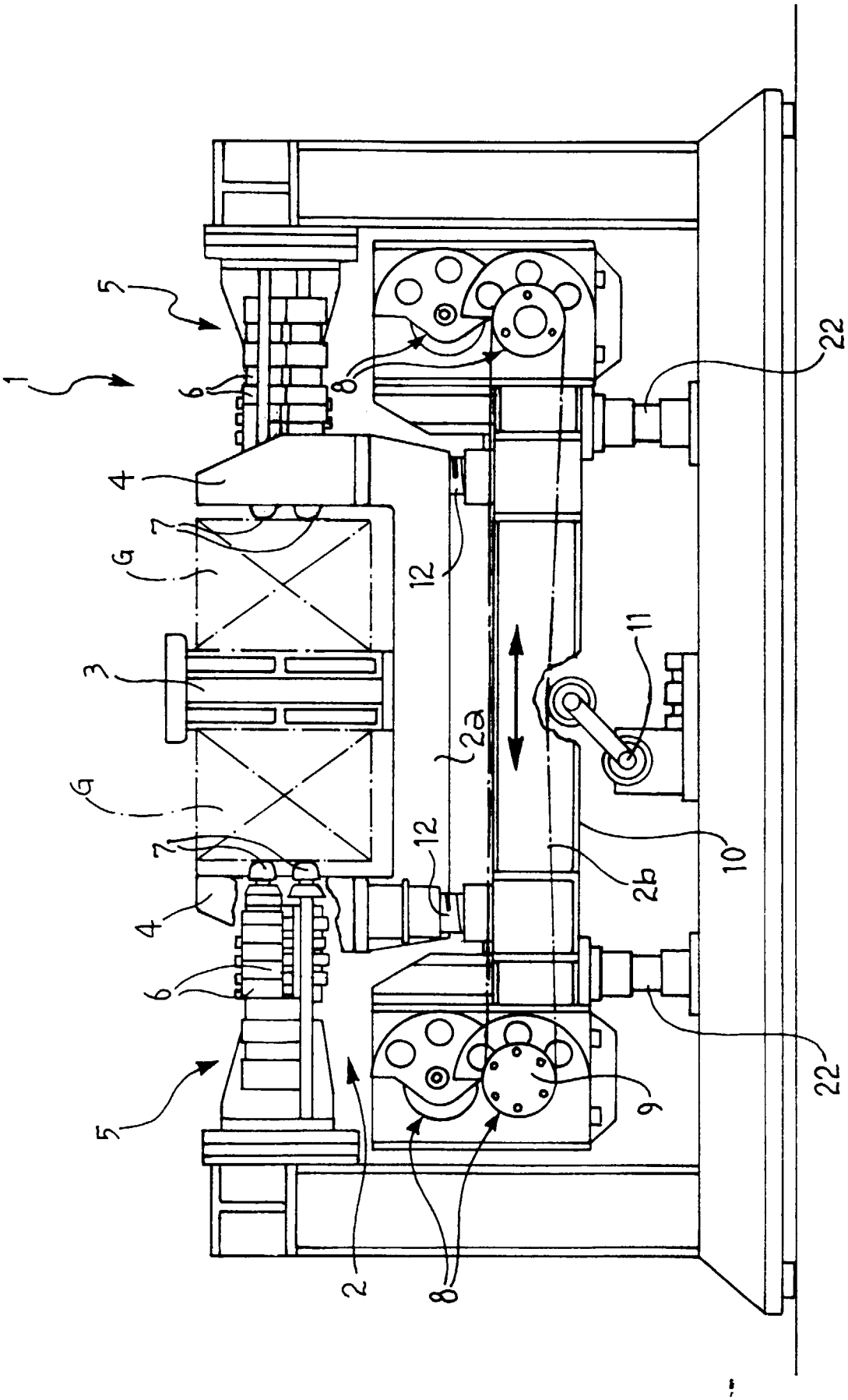
6. A machine according to any one of the preceding claims, characterized in that it further comprises percussion means (5) which can perform a percussion action on the castings (G) to be shaken out, and in that the second portion (2b) of the support structure (2) and the vibrator means (8) acting on the second portion (2b) are substantially isolated from the action of the percussion means (5) as a result of the suspension of the first portion (2a) as a vibrating system relative to the second portion (2b).

7. A machine according to any one of the preceding claims, characterized in that the vibrator means (8) can be driven selectively (9, K) in a normal operating condition at a frequency substantially corresponding to the resonance frequency of the vibrating system (2a, 12), as well as in conditions in which the frequency increases and decreases towards and away from the normal operating frequency, respectively.

8. A machine according to any one of the preceding claims, characterized in that the vibrator means (8) are configured for imparting a vibration with an amplitude of about 2-3 mm to the second portion (2b) of the support structure.

9. A machine according to any one of the preceding claims, characterized in that, in resonance conditions, the vibrating system (2a, 12) causes the first portion (2a) to vibrate with an amplitude of the order of 13-14 mm.

10. A machine according to any one of the preceding claims, characterized in that the vibrating system (2a, 12) has a resonance frequency of the order of about 30 Hz.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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0686

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 4 722 386 A (CASEY DWIGHT P) 2 February 1988 * column 1, line 25 - column 2, line 4; figures 1-7 * * column 2, line 25 - column 5, line 8 *	1-10	B22D29/00
X	US 4 718 473 A (MUSSCHOOT ALBERT) 12 January 1988 * column 1, line 63 - column 2, line 47; figures 1-5 *	1,2,4,5	
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A	FR 2 730 436 A (PEUGEOT) 14 August 1996 * page 3, line 21 - page 5, line 31 *	1-10	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B22D
B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 April 1999	Mailliard, A

CATEGORY OF CITED DOCUMENTS

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