

March 3, 1942.

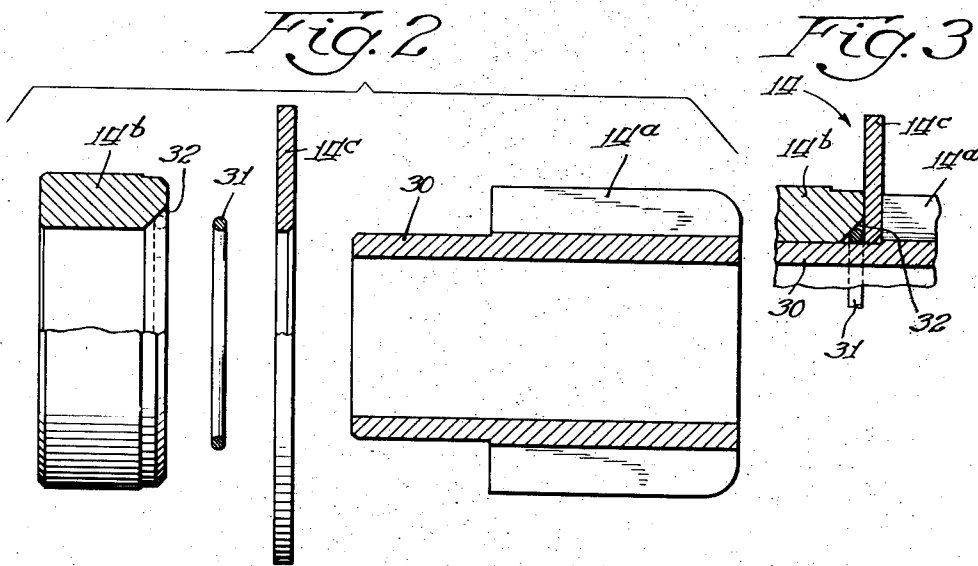
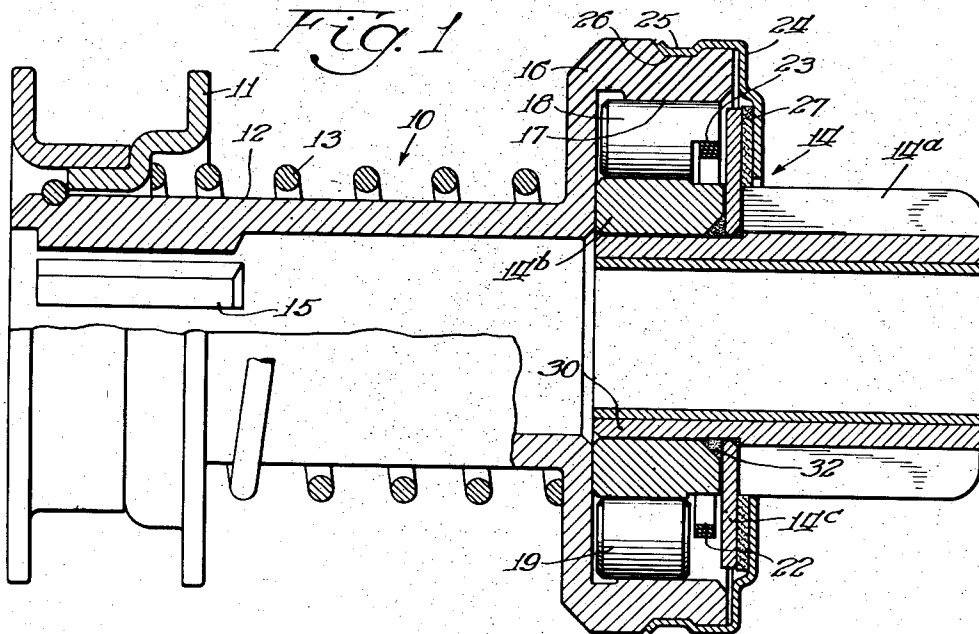
W. B. CRANS

2,275,177

COMBINATION BONDING AND HEAT TREATING

Filed March 29, 1939

2 Sheets-Sheet 1



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Fig. 4

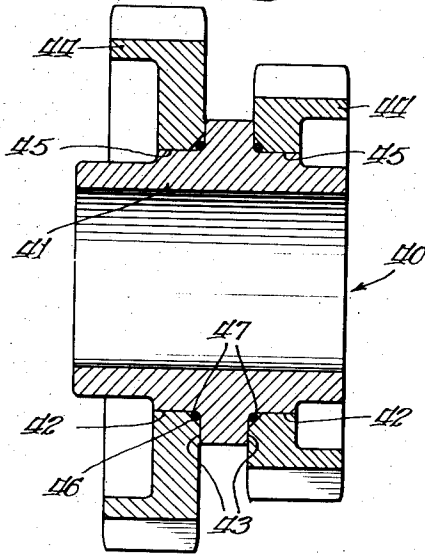


Fig. 5

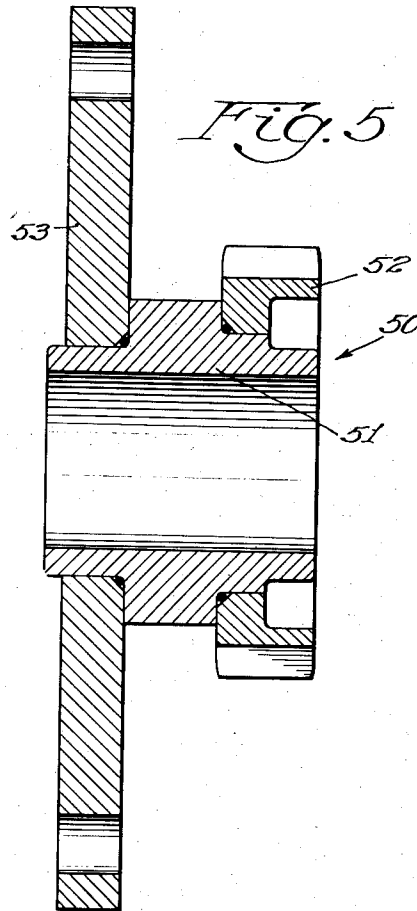
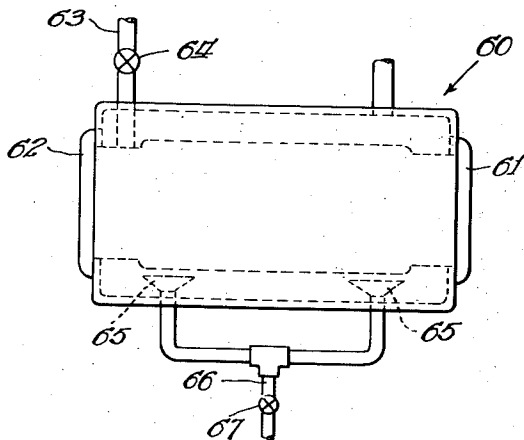


Fig. 6



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UNITED STATES PATENT OFFICE

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COMBINATION BONDING AND HEAT
TREATINGWalter B. Crans, Royal Oak, Mich., assignor to
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Application March 29, 1939, Serial No. 264,707

4 Claims. (Cl. 29—152)

This invention relates to a process for bonding and heat-treating a plurality of metal elements in the form of a single structure in one operation, and particularly to an improved metal for fabricating the flywheel engaging pinion and associated flange and clutch hub of an automotive starter clutch.

In the manufacture of one piece assemblies comprising a hub or central member in conjunction with a flange, gear, arm, or other metallic elements of the like formed on portions thereof, it has been found impractical and unsatisfactory to fabricate such pieces from one piece of metal stock. The loss in time and material alone has rendered this procedure impracticable. I have found that this condition is particularly true in the case of a gear, hub and flange assembly forming part of a one-way starter clutch.

It is an object of this invention to provide a process for fabricating a single metal structure from a plurality of separate parts by bonding the parts together in a novel manner and subjecting the same to a carburizing zone, or a carburizing and hardening zone, or a hardening zone, or a molten cyanide bath, or a Chapmanizing bath, or a molten lead bath, or a molten salt bath, or a combination carburizing and nitriding bath, or nitriding zone, or a combination carburizing and nitriding zone, or an annealing zone, or a normalizing zone in a new and improved manner.

It is still another object to provide a starter clutch pinion assembly that is of relatively light weight to reduce the spin that is normally imparted to the starter motor in arrangements where the starter clutch pinion assembly has a large rotating mass.

The above and other objects, advantages and uses of my invention will become more apparent from a reading of the following specification and claims taken in connection with the appended drawings which form a part of this specification and wherein:

Fig. 1 is a vertical elevation section of a starter clutch assembly incorporating a combination of elements bonded together in accordance with a preferred embodiment of my invention;

Fig. 2 is an exploded view partly in section of the gear, flange, hub and brazing rod;

Fig. 3 is a broken away section view showing the elements of Fig. 2 in their assembled relationship prior to the brazing and carburizing operation.

Fig. 4 is an elevation partly in vertical section of a gear or sprocket cluster incorporating a hub

member, the combination of elements bonded together in accordance with my invention;

Fig. 5 is a combination of flange, a gear or sprocket member and a hub member bonded together in accordance with a procedure as disclosed in this invention; and

Fig. 6 shows schematically a furnace arrangement for carrying out my novel carburizing and brazing operation.

Referring in greater detail to the figures of the drawings, I have indicated generally at 10 a starter clutch assembly in which my improved gear flange and hub combination fabricated in accordance with my improved process is particularly adapted for cooperation. This starter clutch assembly 10 includes generally a peripherally channeled collar member 11 mounted on a driving tubular shaft 12 for axial movement relative thereto opposed by compression springs 13 for resiliently shifting the driving housing to cause the same to move the teeth of a gear 14a of my novel gear assembly indicated generally at 14 into mesh with the internally formed teeth of a motor flywheel (not shown). A suitable fork and linkage arrangement connected with a foot or other manually operated button (not shown) is provided for effecting the axial reciprocation of collar 11. Internal splines 15 provide for axial non-rotative movement of shaft 12 relative to a starter motor operated complementarily splined shaft (not shown). The forward end of shaft 12 is enlarged to provide a casing 16 formed with an internal guideway 17 for cooperation with a plurality of roller bearings 18 and 19 cooperating with an inwardly disposed hub 14b forming part of my novel gear assembly 14 and together defining a one-way clutch. A coil spring 22 cooperates with shoulders 23 on alternate rollers 18 for effecting the one-way clutch operation. Rollers 18 are somewhat longer than rollers 19 and shoulders 23 are provided by recessing one-half of the respective rollers, a distance slightly greater than the width of the spring 22 along a diameter of the roller.

A housing 24 is formed with a distortable clip-like portion 25 capable of being forced into engagement with peripheral channels 26 about the housing 16 and carries on the inside thereof a friction facing 27 for cooperation with radially extending flange 14c of gear assembly 14. This arrangement is such that when hollow shaft 12 is drawn axially to the left in Fig. 1, friction facing 27 engages radial flange 14c for withdrawing gear teeth 14a from engagement with the inner peripheral teeth on the flywheel (not shown).

Bonding and heat treating

Referring to Fig. 2, I have shown an exploded view of the separate parts subsequently to compose my novel gear and clutch sub-assembly and including a gear formed with coaxially extending cylindrical protuberance 30 adapted to receive radially extending washer or flange 14c and roller cooperating hub 14b, with brazing rod 31 interposed between recessed face portion 32 of hub 14b and the adjacent face portion of flange 14c. This assembled relation is shown in broken away section in Fig. 3.

Prior to the assembly of the parts shown in exploded relation in Fig. 2, the surfaces are thoroughly cleaned. The brazing compounds as well as the surfaces of the parts to be brazed are also covered with a suitable flux such, for example, as that known to the art as: borax, boracic acid, or Handy Flux.

While the exact order of the performance of the above operations may be varied within obvious limits, I prefer to carry out the same by first, cleaning the surfaces to be bonded, next applying the bonding medium, covering these surfaces with a suitable flux, then assembling the same. Assembled parts are next inserted into a gas carburizing atmosphere, of sufficient temperature to effect the brazing operation as well as to effect the carburizing of the structure. I have found that where the usual metals employed in the fabrication of this class of equipment are used that a temperature of from 1700 to 1750 degrees F., preferably about 1720 degrees F., produces very satisfactory results. When the carburizing has reached the desired depth the parts are next quenched in a suitable medium such as, for example, quenching oil.

The resulting product is a solid unit, brazed, carburized and hardened in one continuous operation.

While I consider it an important part of my invention to carburize the assembly during the bonding thereof I also contemplate the use of my novel method of bonding in combination with other treatments.

I have found that an improved structure is produced by including a treatment thereof in either a molten cyanide bath, or a Chapmanizing bath, or a molten lead bath, or a molten salt bath, or a combination carburizing and nitriding bath, or nitriding zone, or a combination carburizing and nitriding zone or an annealing zone, or a normalizing zone. Of these treatments I have found particularly that a combination of carburizing and nitriding atmosphere produces definitely improved results.

I have described above my invention in connection with a very specific application thereof in respect to which I have found that it has novel and unexpected advantages. However, it is to be understood that my novel process has a valuable broad general application as applied to the fabrication and bonding of individual metal elements together to form a single unitary structure in other relations than starter clutches.

In Figs. 4 and 5 I have illustrated certain additional examples of one-piece assemblies fabricated by bonding a plurality of elements together in accordance with my novel process. In Fig. 4, a unitary assembly indicated generally at 40 is composed of a hub member 41 formed with reduced cylindrical portions 42 and shoulders 43. Gears 44 are formed with central openings 45 complementary in size to cylindrical portions 42

on hub 41 for reception thereon. Gears 44 are recessed as indicated at 46 to provide an annular groove for the reception of a ring of bonding material 47. These parts are assembled and bonded together to form a one-piece structure in accordance with the steps described in connection with Figs. 1 to 3.

In Fig. 5 I have illustrated a slightly different arrangement wherein a one-piece assembly is formed in accordance with my novel process, which assembly is referred to generally at 50 and comprises a hub 51 to which there is bonded in very much the same manner as in the preceding figures, a gear 52 and a flange disc 53.

I have indicated schematically in Fig. 6 an arrangement for carrying out my novel bonding and heat-treating process including a furnace generally referred to at 60, having doors, 61 and 62, giving access to a muffle and provided with a conduit connection 63, containing valve 64 for introducing a suitable atmosphere such for example as a carburizing atmosphere. Such a carburizing atmosphere may comprise commercially available material known to the trade as natural gas, artificial gas, butane, propane, solid carburizing compounds, or any carburizing medium. For heating the furnace there is indicated gas burners 65, intake lead 66, and control valves 67. In actual practice any other well-known source of heat such, for example, as coke, coal, oil, electricity, etc., may be employed as well as the necessary additional valves, conduits, etc., not essential to an understanding of the present invention.

While I have described my invention in connection with one specific embodiment thereof, it is to be understood that this is by way of illustration and not by way of limitation, and that the scope of my invention is to be defined solely by the appended claims which should be construed as broadly as the prior art will permit.

I claim:

1. A method of producing a starter gear and clutch sub-assembly including a toothed gear having a cylindrical extension, a radially extending washer closely embracing said cylindrical extension adjacent said gear teeth, and a hub mounted on said cylindrical portion closely adjacent to said washer, said method of producing a starter gear being particularly characterized by the steps of interposing a brazing medium between at least two of the opposed surface portions of said elements, and subjecting said assembled elements to a gas carburizing atmosphere of sufficiently high temperature to produce brazing and to produce carburizing to the desired depth and then quenching the resulting bonded elements in a quenching medium.

2. In a process for bonding together a plurality of separate metal elements to form a built-up sub-assembly of a gear and clutch combination, said elements to be bonded together including a gear having an axially extending cylindrical portion adjacent the gear teeth thereon, a radially extending washer embracingly received about said cylindrical portion and disposed closely adjacent the end of said teeth, and a cylindrical hub member embracingly received about said cylindrical portion in close relation thereto and to said washer member, said arrangement being particularly characterized by the formation of a peripheral recess in the under surface of said hub in the area of juncture between said washer and said cylindrical portion for the reception of a brazing ring therein,

the novel steps in bonding said elements together comprising assembling said elements with a ring of brazing material interposed in said recess, subjecting the assembled parts to a gas carburizing atmosphere at a temperature sufficiently high to produce brazing and to produce carburizing to the desired depth, then quenching said assembly in a quenching medium.

3. In a process for bonding together a plurality of separate metal elements to form a built-up sub-assembly of a gear and clutch combination, said elements to be bonded together including a gear having an axially extending cylindrical portion adjacent the gear teeth thereon, a radially extending washer embracingly received about said cylindrical portion and disposed closely adjacent the end of said teeth, and a cylindrical hub member embracingly received about said cylindrical portion in close relation thereto and to said washer member, said arrangement being particularly characterized by the provision of a peripheral recess defined by spacing juxtaposed surfaces in the area of juncture between said washer and said cylindrical portion for the reception of a ring-like piece of

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oxweld brazing rod No. 25M, the novel steps in bonding said elements together comprising assembling said elements with a ring-like piece of said brazing rod interposed in said recess, subjecting the assembled parts to a gas carburizing atmosphere at a temperature of from between 1700 and 1750 degrees F., preferably about 1720 degrees F., to produce brazing and to produce carburizing to the desired depth and then quenching said assembly in a quenching medium.

4. The method of fabricating a starter clutch pinion assembly comprising forming coaxial teeth on the forward portion of a piece of tubular stock, forming a reduced cylindrical portion on the rear of said tubular stock, placing a washer-like flange member about said reduced cylindrical portion and in contact with the rear of said toothed portion on one side, placing a sleeve-like hub member about said reduced cylindrical portion in engagement with the side of said washer-like flange member opposite to said one side and bonding said elements together to produce a one-piece assembly.

WALTER B. CRANS.