

# The AUTOMOBILE

## WHEN GEARS GROWL.

A lot of business would be lost to automobile mechanics and a lot of trouble would be avoided by owners of cars if there were no such things as gears. Some of the most unnecessary and expensive repairs to an automobile are those connected with its transmission. There is nothing more exasperating to the motorist than that horrible sound which tells a story of stripped gears.

It is not in the permanent mesh gears, where shaft motion is turned into axle motion, that the trouble comes. If the rear axle gears are properly set and packed, they should never make any trouble. But it is in the shifting gears of the transmission, where gears come into mesh at varying rates of speed and with the number of revolutions, load and several other things to complicate the situation, that there is wear and tear. It would not be so bad if there were only wear. The tear is what raises havoc.

## Noise That Means Much.

If an automobile could run at an unvarying rate of speed, if there were no hills which require the translation of speed into power, or if the engine controls alone could give sufficient speed regulation to cover the emergencies that are constantly arising, the transmission might be simplified into a mere coupling and reverse. But this millennium in the automotive world has no indication of coming. Therefore, there must be provision for varying speeds and these must be attained while the car is in motion. Therefore again this means the meshing together of finely built gears revolving so fast that the teeth cannot be seen.

It is no novelty to hear a grinding or clashing within a car when a careless driver starts or when he changes from one speed to another. If such a driver knew what was going on inside of it when this unseemly noise occurs he would probably either hire a chauffeur or else take a few lessons in automotive mechanics to learn how not to abuse his machine in this way. If the driver were a chauffeur and the owner knew what such a noise meant it is likely the chauffeur would be sent to school or be out of a job.

In the mechanism of a simple transmission gear case the engine shaft has on the end a gear wheel and on the face of the gear are four engaging teeth. The end of the shaft is hollow and in this revolves one end of the transmission shaft, which is square. On it are two gear wheels of varying sizes, one having say thirty teeth and the other forty. The smaller is yoked to the larger and both slide along the square shaft when moved by a lever. The gear has on its face engaging teeth corresponding to those on the engine shaft gear, and when the two

are engaged the transmission shaft revolves at the same speed as the engine shaft. This gives the highest speed of which the car is capable.

To provide for varying speeds another shaft is suspended in the transmission case on which are other gears. If one gear has twenty teeth, another will have, say, forty. This reduces the motion of the gear shaft to one-half that of the engine shaft. Further along the gear shaft, another gear with forty teeth, further reducing the speed, so that the transmission shaft revolves one-fourth as fast as the engine shaft, making the low gear, or slowest speed. When the car is standing, the engine is running in neutral and no gear on the transmission shaft is engaged. To start, it is customary to disconnect the engine by disengaging the clutch and to move the lever so that the gears that give the slowest speed will engage. Once the car is underway and it is desired to increase the speed, the lever is shoved forward, moving the transmission gears forward until the gears that give second speed are engaged.

The wise driver, just at the instant of shifting the gear, would throttle down his engine one-half and bring the number of revolutions of the gear shaft to approximately that of the transmission shaft, which is kept in motion by the momentum of the car. He will also stop for an instant in neutral before completing the shift to allow for adjustment. When both gears are revolving at about the same speed, the shift is practically noiseless and frictionless.

In shifting to high speed the engine should be throttled more closely and the shift lever should hesitate again, if one would avoid the thump and jerk commonly felt when high gear is thrown in. Constant jerking and jumping, thus caused, rack the mechanism, chassis and body and shorten the life of each. Economy as well as comfort is involved in shifting gears properly.

**Reversing Is Special Problem.** In reversing, to back the car, the gear operation intensifies the problem. In addition to the difference in speed and variance of teeth revolutions, there is added the contrary direction of the two gears which are to engage. To throw back on reverse, even at moderate speed, menaces the gears and shakes things up uncomfortably. Fortunately, it is almost invariably necessary to full stop the car before reversing, and the necessity of caution in backing prompts very low speed throughout the operation.

Stripping of gears and also unnecessary wear and tear on them can be avoided by intelligent and careful driving. And much enjoyment will be added to the motorist's life and much less in repair bills will be subtracted from his pocketbook.

## UNCLE ALFRED ARRIVES

Samuel Gossey looked across the breakfast table at his wife in some excitement.

"Martha," he cried, "here's a letter from Uncle Alfred! And what do you think? He's back in England and wants to see his relations."

Martha Gossey sat up very straight. "You and Joe are the only blood relatives he has left, aren't you?" she asked.

"Yes, that's right; and I being the elder brother, he's written to me. This means Joe won't know anything about uncle's arrival until I tell him."

"And there's no need to tell him yet," put in Martha, with an unpleasant laugh.

"Quite right, my dear. We've got to have first innings with Uncle Alfred who must be a very rich man now, after spending twenty years as a merchant in China. The thing is for us to capture his affections, so to speak, and then we'll let him meet Joe and Bessie after he's taken a fancy to us."

"When's he coming here, Sam?"

"He wants to come next Tuesday, Martha. He's in London at present."

"All right," she said; "I'll have everything ready for him on Tuesday. And look here, Sam, I think it would be a good thing if you were to go up to London and fetch him down on that day. He's not used to travelling in England, and there's nothing like creating a good first impression with a man like your uncle."

"You're absolutely right, as usual, Martha. I'll go to town on Tuesday and bring the old boy back with me!"

The Sam Gosseys were quite comfortably off, so could not be excused for their greediness to get more money. They were cute enough, however, to realize that in the present case the expenditure of a little money was well worth while. Accordingly, they laid in a fine stock of dainties, together with several bottles of wine, in preparation for their Uncle Alfred's coming.

Meanwhile, Sam wrote to say he would be in London on the Tuesday, and that it would give him great pleas-

ure to escort his uncle down to Cranly, where the Sam Gosseys lived.

Rigged up in his best clothes, Sam set out for town early on the eventful Tuesday morning. At the Great Western Hotel he found his Uncle Alfred, a bluff, broad-shouldered old gentleman, with a mat of thick white hair and shrewd blue eyes.

"It's very nice of you to come and look after me like this," declared Uncle Alfred, after they had exchanged greetings.

"I'm only too delighted to be of any assistance to you, uncle," replied Sam piously.

"Is Joe coming, too?" asked Uncle Alfred.

"Oh, no, Joe can't be bothered going out of his way to please people! He was always a self-centred sort of chap, and not much of a credit to the family either, if it comes to that."

"I'm sorry to hear you say so, Sam. Is Joe a wrong 'un, then?"

"Well, I won't go so far as to say that; but he's never really made good. He lives down at Eastport with his wife, Bessie, and I suppose he just manages to make enough to live on. We'll try to get him and Bessie over to Cranly one day, and then you can judge for yourself."

The conversation drifted to other topics, and in due course they set out to catch their train. Sam was master of the ceremony. He took the tickets and gave the porter orders about the luggage.

When it had been stowed in the van Sam gave the man three pence. The porter looked at Sam and then at the money. He seemed about to say something, but thought better of it, and went off with a sarcastic grin.

There was considerable commotion on the platform, and Uncle Alfred, who didn't want to miss anything, pushed into the crowd, followed by Sam. The people were collected before a special coach in the Cranly train, and Uncle Alfred soon discovered what they were looking for.

A Cabinet Minister was going by this train to unveil a war memorial at some place down the line.

That was what someone told Uncle Alfred, and just afterwards the Minister and his party appeared, and everyone stared harder than ever, including Uncle Alfred, who had not seen a celebrity for twenty years.

So engrossed was his uncle in the movements of the Minister that Sam Gossey had some difficulty in getting him into the train. However, they did manage to get into a compartment in

—and the worst is yet to come



the coach next to the Minister's and so all was well.

"We go straight through to Cranly Junction, change there, and have a ten minutes' run on from there to Cranly," explained Sam, as they both settled themselves comfortably in opposite corners.

Uncle Alfred read his paper, smoked a couple of pipes, and finally dropped off into a doze. Sam watched the stations they passed impatiently. He was longing to get Uncle Alfred safely home; this visit was going to mean money, he told himself, money for himself and Martha. He was very greedy, was artful Sam!

At last they approached the outskirts of Cranly Junction. Sam's eyes lit with excitement; then he looked puzzled. Then he started forward, staring through the window with astonishment and dismay. Instead of slowing up, the train was dashing along faster than ever. They rushed through Cranly Junction at about fifty miles an hour.

Sam dropped back into his seat with a groan. Where would they stop, he wondered, and what would Uncle Alfred say? Then he remembered the grin of the porter and that sarcastic grin, and the truth began to dawn on him.

The Cranly portion of this train had probably been behind; the coach they were in was attached to the Cabinet Minister's coach, which would go direct to its destination by special arrangement, to-day. Sam had not thought to make inquiries, because he had travelled home dozens of times before by this train. But then there had been no Cabinet Minister making the journey.

On they whirled, while beads of perspiration began to appear on Sam's brow. There was no knowing how Uncle Alfred might take this mistake; and as for Martha—Sam could guess the sort of thing she'd say! He did not like to wake his uncle up and confess the truth, so he just sat there glaring angrily out of the window.

The train dashed through a short tunnel and entered the outskirts of some town. Then it began to slow up, while loud cheers rang through the air. Uncle Alfred opened his eyes, heard the cheering, and looked out of the window.

"This is the place where that big pot's going to make his speech, Sam," he said, over his shoulder. "Yes, there he is, getting out, and they've made a pathway for him out of the station. Come along, Sam, let's get the luggage!"

But they looked for the luggage in vain, because the Cranly luggage-van, with the Cranly portion of the train, had been taken off about fifty miles farther back. The next train to Cranly left in three hours, a porter told them, as they stood disconsolately on the now almost deserted platform.

Suddenly a cheery voice reached their ears, and they both turned round with a start.

"Why, hello, Sam! What on earth are you doing at Eastport?" cried the voice.

And Sam saw his brother Joe standing before him, with hand outstretched.

Sam tried to look cheerful as he shook hands with his brother, but he felt the very opposite. That they should be stranded at Eastport, of all places, seemed to him the limit.

"This is Uncle Alfred, Joe," said Sam awkwardly.

Joe took off his hat, and grasped his uncle's hand.

"Why, I thought you were in China, sir!" he said. "When did you arrive home?"

"Didn't Sam tell you of my arrival, then?" asked Uncle Alfred with a shrewd glance at his elder nephew.

"I was busy, and forgot!" Sam muttered.

of show, of course, but I expect you'll make allowances."

"Of course—of course, my boy!" cried Uncle Alfred. "Come along now!"

"I must wire to Martha," said Sam sulkily.

"All right, you follow us. You know the way!" laughed Joe.

"Your brother's a curious fellow," remarked Uncle Alfred, as he followed Joe from the station.

"He's too serious," Joe said carelessly. "Now, this way, uncle, and we shall avoid the crowd. What a lucky thing I came to the station to see that sweet arrive to-day!"

And he went on chatting about one thing and another in his cheerful way until they reached their destination. Uncle Alfred showed a fresh side of himself once he was inside Joe's home. While Joe and Bessie went off to make preparations for his entertainment, Uncle Alfred and the kiddies had a great game of hide-and-seek. It was during this game that Sam arrived at the house. Joe beckoned him into the kitchen.

"Look here, Sam!" he said, "I wonder if you could lend me a couple of pounds? You see, we didn't expect visitors to-day, and there's not much money in the house. But we'd like to give uncle a good meal, as a sort of welcome home, you know."

"I'm not going to lend you money!" Sam snapped. "Uncle is staying with me, and it's only by mistake that he's here at all. Paupers like you are not expected to entertain! Give him a cup of tea, and he and I will catch the next train back to Cranly."

Sam stalked out of the kitchen as Bessie entered it. Joe turned to his wife.

"Keep uncle amused," he said, "till I come back."

"But where are you going, Joe?"

"Only round to the pawnshop, Bess. We must do our best to entertain uncle, even if he is only here for a few hours, and Sam won't lend me any money."

The game of hide-and-seek continued to the accompaniment of shrill shrieks of delight. At last Uncle Alfred sank exhausted into a big chair in the parlor. Then came the high tea.

It was obvious that the little Gosseys were not accustomed to so sumptuous a meal; and although Sam maintained a supercilious air and ate little, Uncle Alfred appeared to enjoy himself enormously.

At last Sam pulled out his watch. "We must be going, uncle," he said, "or we shall miss that train to Cranly."

"Very well," replied his uncle genially, "you get along to the station, Sam!"

"But, uncle, you'll miss the train if you don't come, too!"

"I don't care," laughed Uncle Alfred. "I'm quite comfortable here!"

"Run along Sam, and get home!" returned the old gentleman firmly; and something in his eye cut Sam's arguments short.

He left the room, grumbling inaudibly to himself.

When tea was over, and the children had been dismissed to amuse themselves in the back yard, Uncle Alfred turned to Joe and Bessie.

"My dears," he said, "I can't tell you how much I've appreciated this welcome of yours! All the more so because I know you can't afford it! Yes, you see, it was my turn to be hiding when you had that talk with Sam. I was behind the corner of the kitchen dresser, and heard everything. But your money troubles are all over now. Sam's well enough off to live in comfort, and it won't be your old uncle's fault if you don't live in comfort, too, from this time forward!"

And Uncle Alfred was as good as his word.

**Cheap Experience.** Second-hand experience is almost as good as new, and it costs less.

Queen Mary is 54 years of age.

## Miracles of Modern Mechanism

If our forefathers of a hundred years ago could revisit the earth, few of our twentieth-century marvels would astonish them more than the amazing degree of accuracy to which measuring machines have been brought.

Take, for example, the Pratt-Whitney machine with which one can measure the thickness of a fly's wing to one two-hundred-thousandth part of an inch.

By its means you discover that the average cigarette-paper is one-thousandth part of an inch thick; and, if it were a hundred times as thin, you could still measure it with perfect accuracy with this marvellous machine, which is used for testing engineers' standard gauges.

Even the Pratt-Whitney machine is a clumsy instrument compared with one designed some years ago by Sir Joseph Whitworth, which will detect a difference as small as the one-millionth part of an inch.

No less wonderful is the dividing engine used for drawing parallel lines of almost inconceivable nearness. One machine, constructed by Lord Blythswood, can draw nearly a hundred parallel lines on a space no wider than the rim of a half-penny.

A blood corpuscle is so small that it is visible only under a strong microscope, and yet it can be cut into three equal parts by a wonderful machine

known as the Ricking Microtome. If you take a cubical piece of paraffin wax, measuring one inch in each direction, you can, by this machine, cut it into twelve thousand slices, with which you could cover every square inch of a floor ten feet long and a little over eight feet wide.

In the measurement of time mechanical perfection is almost as amazing. Time was when a sailor could determine his longitude only by the help of his chronometer, within a margin of eighteen miles. Today, there are chronometers which can be taken to the other end of the world and back, and only show a variation of about ten seconds in as many weeks.

The electrometer, for detecting the smallest variation in an electric current, can record a variation of one-sixteen-billionth part of an ampere, which is said to be the equivalent of a single drop in 125,000 million gallons.

It has been possible for some time to photograph a bullet, travelling at a speed of 1,400 miles an hour, as distinctly as if it were stationary.

For this purpose no camera is used, but the shadow of the bullet is defined on a sensitive plate. The bullet in its flight touches a system of carefully arranged wires, making an electrical connection and causing a brilliant spark which casts the bullet's shadow on the plate.

## THREE NEW SECRETS ABOUT HUMAN FOOD

BY A CELEBRATED ENGLISH PHYSICIAN.

### Mysterious Food Elements Essential to Our Well-Being, Very Easily Overlooked.

Nature has just yielded up to science three new secrets about the food we eat.

These secrets are vital. They revolutionize all our ideas about food, and they make it probable that we shall soon be able to avoid many of the dangers and diseases which have troubled us during past years.

As is usually the way with scientific discoveries, the secrets have been given rather unappetizing names. They are called "Vitamin A," "Vitamin B," and "Vitamin C." Moreover, though we know now that these curious things exist, we do not, as yet, know what they are. No one has ever seen them; no one has ever tasted them. All—absolutely all—that is known about them, is that they are essential to health. For if an animal or a man is fed on food which lacks them, disease and death follow.

#### Traced, But Not Seen.

They were not found by seeking. They were found by that kind of guesswork which is really not guesswork at all, but a process of deduction from things known to things unknown, the method which Sherlock Holmes employed so brilliantly.

Medical men noticed that some kinds of food—for example, butter—made healthy children when given in one form, and failed to make healthy children when given in another form—for example, margarine, with no animal fat in it. It was fair to suppose that the change in the form of the food had taken away from it something vital to life. That something is a "Vitamin."

It was taught in the old days that there were four absolutely essential elements in human food—flesh elements, starch elements, and fat and salts. But experiment showed that young animals fed on these four elements in a carefully-purified state did not grow, and indeed wasted away. So that there remained a fifth element which was present in unpurified food, but might be absent in the purified.

A little, a very little, light has been cast on this subject in far-off days by the discovery that sailors who got no fresh vegetables developed scurvy. Thus it was ordered by the Board of Trade that every ship should carry a supply of lime-juice, and that sailors should have this or fresh vegetables in their diet. It had also been suggested in connection with a disease called beri-beri, a curious kind of wasting paralysis very common in the East, that it arose in consequence of eating polished rice—that is, rice deprived of its husks.

#### What "Vits" Are.

These two discoveries really opened the way to the new work, but their full importance was not at first understood.

We may pass over the history of the experiments and come to the secrets themselves. Vitamin A is also called "Fat-Soluble A," because it is present in some kinds of fat. The richest stores of it are in butter and the yolk of eggs, but it is also present in various animal oils. It is not present in much abundance in vegetable oils, and so margarine made from vegetable and not from animal fats will contain little or none—an important matter in these days.

Lard, too, contains very little of it. Animals which are not getting enough Fat-Soluble A do not grow, and become weak and liable to disease, especially of the eyes. They may become almost totally blind, and some eye diseases in men are now traced to wro<sup>g</sup> kinds of diet.

The second secret is spoken of as "Water Soluble B," because the unknown substance dissolves in water. Thus water in which a cabbage has been boiled will contain it, and yet the cabbage itself, after boiling, will not. This is the substance the absence of which from the rice-grain causes beri-beri. It is present in various grains, as well as in many vegetables.

Thus bread made of white-meal is deficient, while whole-meal bread contains the Vitamin. The "B" substance is also found in peas and lentils and beans, and in eggs and yeast. Meat is rather deficient in it, and so are milk, fish, and cheese.

The final secret, "C," is the substance the lack of which produces scurvy. The substances which contain this element in the largest amount are fresh vegetables, raw cabbage leaves, turnip juice, and the juices of lemons and oranges. The potato is less effective, and cooked foods are much less useful than raw ones. Dried vegetables are useless, and milk and meat not of great utility.

More recent work has suggested that rickets is also a so-called "deficiency" disease, and some doctors have gone the length of saying that our habit of using tinned and frozen food is a bad one, because these articles may contain less of the mysterious elements than fresh food. But the evidence on this point is far from conclusive.

What does seem to be certain is that everyone should aim at a "well-balanced" dietary. That is to say, we ought to vary our food as much as possible, trying to include in our diet many different elements. The war made this difficult, and so now do the high prices. Yet the difficulties are not really great. If butter cannot be bought, margarine may be obtained, which has in it a proportion of animal fat—e.g., milk or cream. Also dripping can be used as a substitute. This secures enough of the "A" element.

#### Don't Forget the Fruit.

The "B" element can be obtained by eating brown bread or "standard" bread instead of the white variety, and by using peas and lentils. Finally, fresh fruit, oranges for example, can be added occasionally to the diet. In this way we shall ensure ourselves and our children enough of the subtle elements upon which, it would appear, health and strength so largely depend.

The way these substances were proved to exist was this. Purple and other animals were fed on say, vegetable margarine. They became gradually weaker. Then a little animal fat, say milk or butter, was added to their food. At once they became well and strong again. It was clear that the animal fat contained some vital substance not present in the vegetable fat. That substance was too small to see, but it certainly did exist. It was called "A." And so with the others.

#### A Terror of the Sea.

Can you imagine a snail so big and so powerful that he can overcome the strongest man?

His name? Why, the octopus, that fearsome monster whose eight long arms, covered with powerful suckers, can enfold and hold fast the strongest human swimmer or the fiercest and most active fish. The octopus is a huge snail, whose shell is contained within his body.

Normally he lives at the bottom of the sea, thrusting his soft pulpy body into a hole in the rocks, and allowing his tentacles to wave to and fro in the water in search of any luckless prey that may come their way. If one of his arms touches anything living it adheres to it immediately. First one arm and then another is wrapped around the struggling thing until it is held so fast that it is incapable of movement. Then the tentacles contract and bring their captive to the beak-like mouth.

The octopus can move through the water at an amazing speed. He does this by filling his body with water, and then squirting it out violently. If pursued by an enemy he throws out a kind of smoke screen by discharging the contents of his siphon-bag.