Text 9. The Next 20 Years of Microchips

1. Read and translate text 9.
2. Memorize the meaning of the following words from text 9:
   - to shrink — уменьшиться в размерах, сжаться;
   - relentlessly — постоянно, беспрестанно:
   - ceaseless — непрекращающийся;
   - to impose — навязывать;
   - hurdle — барьер, препятствие;
   - crossbar — перекрестный;
   - memristor — мемристор, запоминающий резистор.
3. Give a short summary of text 9.

The Next 20 Years of Microchips

Designers are pushing all the boundaries to make integrated circuits smaller, faster and cheaper.

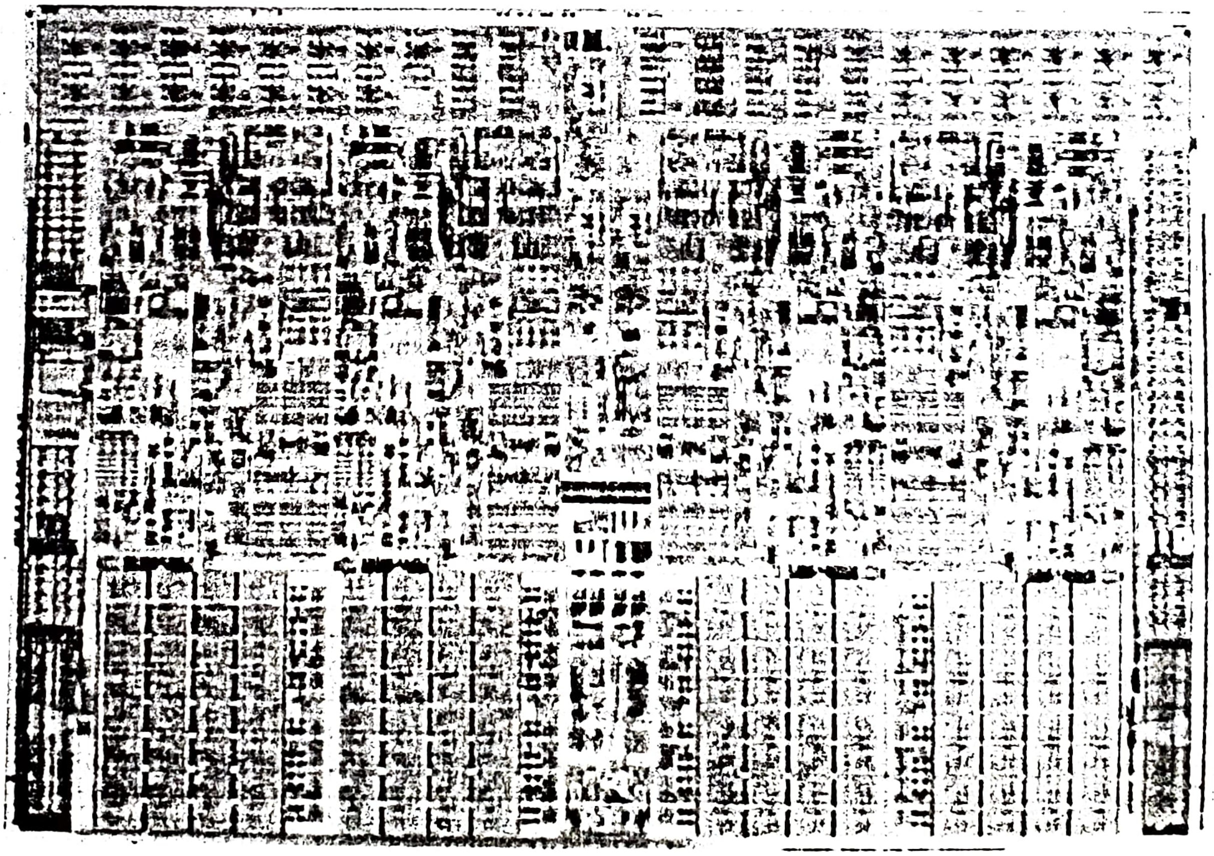

Fig. 3. Microchips

In 1975 electronics pioneer Gordon Moore famously predicted that the complexity of integrated-circuit chips would double every two years. Manufacturing advances would allow the chip's transistors to shrink and shrink, so electrical signals would have to travel less distance to process information. To the electronics industry and to consumers, Moore's Law, as it became known, meant computerized devices would relentlessly become smaller, faster and cheaper. Thanks to ceaseless innovation in semiconductor design and fabrication, chips have followed remarkably close to that trajectory for 35 years.

Engineers knew, however, they would hit a wall at some point. Transistors would become only tens of atoms thick. At that scale, basic laws of physics would impose limits. Even before the wall was hit, two practical problems were likely to arise. Placing transistors so small and close together while still getting a high yield — usable chips versus defective ones — could become overly expensive. And the heat generated by the thicket of transistors switching on and off could climb enough to start cooking the elements themselves.

Indeed, those hurdles arose several years ago. The main reason common personal computers now have the loudly marketed "dual-core" chips — meaning two small processors instead of one — is because packing the needed number of transistors onto a single chip and cooling it had become too problematic. Instead computer designers are choosing to place two or more chips side by side and program them to process information in parallel.

Moore's Law, it seems, could finally be running out of room. How, then, will engineers continue to make chips more powerful? Switching to alternative architectures and perfecting nanomaterials that can be assembled atom by atom are two options. Another is perfecting new ways to process information, including quantum and biological computing. In the pages ahead, we take a look at a range of advances, many currently at the prototype stage, that in the next two decades could keep computing products on the "smaller, faster, cheaper" path that has served us so well.

The smallest commercial transistors now made are only 32 nanometers wide — about 96 silicon atoms across. The industry acknowledges that it may be extremely hard to make features smaller than 22 nanometers using the lithography techniques that have improved for decades.

One option that has circuit features of a similar size but offers greater computing power is known as crossbar design. Instead of fabricating transistors all in one plane (like cars packed into the lanes of a jammed silicon highway), the crossbar approach has a set of parallel nanowires in one plane that crosses over a second set of wires at right angles to it (two perpendicular highways). A buffer layer one molecule thick is slipped between them. The many intersections that exist between the two sets of wires can act like switches, called memristors, that represent 1s and 0s (binary digits, or bits) the way transistors do. But the memristors can also store information. Together these capabilities can perform a number of computing tasks. Essentially one memristor can do the work of 10 or 15 transistors.

Hewlett-Packard Labs has fabricated prototype crossbar designs with titanium and platinum wires that are 30 nanometers wide, using materials and processes similar to those already optimized for the semiconductor industry. Company researchers think each wire could get as small as eight nanometers. Several research groups are also fashioning crossbars made from silicon, titanium and silver sulfide.

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4. Make a list of scientific terms that are used in text 9, give their Russian equivalents and memorize them.
5. Insert the right from of the non-finite form of verbs.

The smallest commercial transistors now (to make) are only 32 nanometers wide — about 96 silicon atoms across. The industry acknowledges that it may be extremely hard (to make) features smaller than 22 nanometers (to use) the lithography techniques that have improved for decades. One option that has circuit features of a similar size (to offer) greater computing power is known as crossbar design. Instead of (to fabricate) transistors all in one plane (like cars (to pack) into the lanes of a jammed silicon highway), the crossbar approach has a set of parallel nanowires in one plane (to cross) over a second set of wires at right angles to it (two perpendicular highways).

A buffer layer one molecule thick is slipped between them. The many intersections (to exist) between the two set s of wires can (to act) like switches, (to call) memristors, that represent 1s and 0s (binary digits, or bits) the way transistors do. But the memristors can also (to store) information. Together these capabilities can (to perform) a number of computing tasks. Essentially one memristor can (to do) the work of